CAMPING AND WOODCRAFT

Vol. II

WOODCRAFT

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TORONTO

CAMPING

AND

WOODCRAFT

A HANDBOOK FOR VACATION CAMPERS

AND FOR

TRAVELERS IN THE WILDERNESS

BY

HORACE KEPHART

Author of "Our Southern Highlanders," "Sporting Firearms," "Camp Cookery," etc.

Two Volumes in One

VOL. II

WOODCRAFT

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CHAPTER I

WOODCRAFT

From the autumn of 1904 to the winter of 1906 I lived, most of the time, alone in a little cabin on the Carolina side of the Great Smoky Mountains, surrounded by one of the finest primeval forests in the world. My few neighbors were born backwoodsmen. Most of them dwelt in log cabins of one or two rooms, roofed with clapboards riven with a froe, and heated by hardwood logs in wide stone fireplaces. Many had no cooking-stoves, but baked on the hearth and fried their meat over the embers.

Nearly every man in the settlement was a skilled axeman and a crack shot. Some of them still used home-made muzzle-loading rifles with barrels over four feet long. Some of the women still worked at home-made spinning-wheels and looms. Coonskins and ginseng passed as currency at the little wayside stores. Our manner of life was not essentially changed from that of the old colonial frontier.

To complete this historic setting, we had for neighbors the Eastern Band of Cherokees, who still hold a bit of their ancient patrimony, on the Okona Lufty. These Indians, while classed as civilized, have by no means forgotten all their aboriginal arts. You may find them, even now, betimes, slipping

like shadows through the forest, killing small game with cane blow-guns, much longer than themselves, and small arrows with thistle-down wrapped round the butts so as to fit the bore.

To one coming from cities, it was a strange environment, almost as though he had been carried back, asleep, upon the wings of time, and had awakened in the eighteenth century, to meet Daniel Boone in flesh and blood.*

In such a situation it was natural, nay imperative, that one should pick up and practice certain arts long lost and forgotten by civilized communities but quite essential in our backwoods way of living. I began, to be sure, with the advantage of experience gained on many hunting and camping trips in other lands; but in this new field I had to make shift in a different way, and fashion many appliances from materials found on the spot. The forest itself was not only my hunting-ground but my workshop and my garden.

Into this novel and fascinating game I entered with keenest zest, and soon was going even "farther back" than the native woodsmen themselves. I gathered, cooked, and ate (with certain qualms, be it confessed, but never with serious mishap) a great variety of wild plants that country folk in general do not know to be edible. I learned better ways of dressing and keeping game and fish, and worked out odd makeshifts in cooking with rude utensils, or with none at all. I tested the fuel values and other qualities of a great many kinds of wood and bark, made leather and rawhide from game that fell to my rifle, and became more or less adept in other backwoods handicrafts, seeking not novelties but practical results.

To what degree I was reverting to the primitive came home to me one day when a white dame, find-

*For an account of this experience, with descriptions of the southern mountains and their primitive inhabitants, see *Our Southern Highlanders*, by Horace Kephart (Outing Publishing Co., New York).

ing Will Tahlahlah giving me a lesson in Cherokee, remarked rather sourly to the redskin: "You needn't teach *him* anything; he's more of an Indian than you are."

Seldom during those three years as a forest exile did I feel lonesome in daytime; but when supper would be over, and black night closed in on my hermitage, and the owls began calling all the blue devils of the woods, one needed some indoor occupation to keep him in good cheer: and that is how I came to write my first little book on camping and woodcraft.

Since then I have spent several more years in "the sticks," at much the same kind of life, save that now I had as partner one of the best woodsmen in this country, a man so genuinely a scholar in his chosen lore that he could well afford to say, as once he did to me: "I've studied these woods and mountains all my life, Kep, like you do your books, and I don't know them all yet, no sirree." And I now say to the reader, for myself, just what Bob said to me about himself, save that my experience covers a less period of time.

In the school of the woods there is no graduation day. What would be good woodcraft in one region might be bad bungling in another. A Maine guide may scour all the forests of northeastern America, and feel quite at home in any of them; but put him in a Mississippi canebrake, and it is long odds that he would be, for a time,

> Perplexed, bewildered, till he scarce doth know
> His right forefinger from his left big toe.

And a southern cane-cracker would be quite as much at sea if he were turned loose in a spruce forest in winter. But it would not take long for either of these men to "catch on" to the new conditions; for both are shifty, both are cool-headed, and both are keen observers. Any man may blunder once, when confronted by strange conditions; but

none will repeat the error unless he be possessed by the notion that he has nothing new to learn.

Woodcraft may be defined as the art of finding one's way in the wilderness and getting along well by utilizing Nature's storehouse. When we say that Daniel Boone, for example, was a master woodsman, we mean that he could confidently enter an unmapped wilderness, with no outfit but what was carried by his horse, his canoe, or on his own back, and with the intention of a protracted stay; that he could find his way through the dense forest without man-made marks to guide him; that he knew the habits and properties of trees and plants, and the ways of fish and game; that he was a good trailer and a good shot; that he could dress game and cure peltry, cook wholesome meals over an open fire, build adequate shelter against wind and rain, and keep himself warm through the bitter nights of winter—in short, that he knew how to utilize the gifts of Nature, and could bide comfortably in the wilderness without help from outside.

When one travels with a guide, it is the guide's woodcraft that pulls him through. When he goes on his own hook, he must play the woodsman himself. Woodcraft shows at its best when we "go light" through difficult and unknown country. Its supreme test is in an emergency, when the equipment, or essential parts of it, have been lost or destroyed through some disaster.

As for book-learning in such an art, it is useful only to those who do not expect too much of it. No book can teach a man how to swing an axe or follow a faint trail. Nor is it of much account to one who merely learns by rote, without using his own wits and common sense as he follows the pages. Yet a good book is the best stepping-stone for a beginner. Without it he might bog and flounder a long time without aim or method. It gives a clear idea of general principles. It can show, at least, how *not* to do a thing—and there is a good

deal in that—half of woodcraft, as of any other art, is in knowing what to avoid. That is the difference between a true knot and a granny knot, and it can be shown by a sketch as well as with string in hand.

In this work I have preferred to give full details, so far as the book goes. One's health and comfort in the wilds very often depend upon close observance of just such details as breathless people would skip or scurry over. Moreover, since this is not a guidebook to any particular region, I have tried to keep in mind a variety of conditions existing in different kinds of country, and have suggested alternative methods or materials, to be used according to circumstances. One might, perhaps, compress into a vest-pocket manual all the expedients of woodcraft that would have to be practised in one certain locality, say the Adirondacks, but it would be of little use in a different sort of country.

Of course, no one person is likely to find all of this volume directly useful to himself. I must ask him to accept my assurance, based on a considerable correspondence with outdoor men in many countries, that there is no chapter in it but is of interest to somebody. Each reader is supposed to pick out for himself what bears on his own problems.

The first volume of this work, *Camping,* is intended mainly for parties who go well equipped and are guided by natives of the country, and who have adequate means of transportation, or for those who go into fixed camp and stay there until the vacation is over. This one, on *Woodcraft,* is for those who travel light, in the real wilderness, rove about a good deal, and sometimes scatter, every man for himself, with his life in his own hands.

In the following chapters I offer suggestions on forest travel, pathfinding, route sketching, what to do if lost, outfits for trips afoot, marksmanship in the woods, emergency foods, qualities and utilization of wood and bark, camp making with tomahawk or axe, cabins and rustic furniture, caches and masked

camps, knots and lashings, buckskin and rawhide, tanning pelts, bee hunting, living off the country, cave exploration, first aid to the injured, and other shifts and expedients that are handy when one is far from shops and from hired help.

I have little to say, here, about the selection of arms and tackle, about hunting, fishing, trailing, trapping, mountaineering, and nothing about field photography, canoeing, snowshoeing, or the management of horses and pack trains, because each of these topics deserves a book by itself, and we now have good ones on all of them.*

Woodcraft properly relates only to the *forest* wilderness. The literature of outdoor sport is getting us used to such correlative terms as plainscraft, mountaincraft, and even icecraft and snowcraft. This sort of thing can be overdone; but we need a generic term to express the art, in general, of getting on well in wild regions of any and all kinds, whether in forests, deserts, mountains, plains, tropics or arctics; and for this I would suggest the plain English compound *wildcraft.*

If any one should get the impression from these pages that camping out with a light outfit means little but a daily grind of camp chores, questionable meals, a hard bed, torment from insects, and a good chance of starvation and broken bones at the end, he will not have caught the spirit of my intent. It is not here my purpose to dwell on the charms of free life in a wild country; rather, taking all that for granted, I would point out some short-cuts, and offer a lift, here and there, over rough parts of the trail. No one need be told how to enjoy the smooth ones. Hence it is that I treat chiefly of difficulties, and how to overcome them.

*See the series of *Outing Handbooks*, and lists of outdoor books in outfitters' catalogues.

CHAPTER II

GETTING LOST—BIVOUACS

When a man fixes up his pack and strikes out alone into strange woods, just for a little adventure, not caring where he may come out, he may be lost all the time, in one sense, but in a better sense he is at home all the time. Not for a moment does he worry about the future; he is exploring new territory —that is all.

But if one sets out for a certain destination, expecting to reach it by a given time, and loses the trail, he will be anxious at once, and the longer this continues, the more it will get on his nerves. Still we would hardly call him lost, so long as he retains a good idea of the general direction in which he should travel.

A man is really lost when, suddenly (it is always suddenly), there comes to him the thudding consciousness that he cannot tell, to save his life, whether he should go north, east, south or west. This is an unpleasant plight to be in, at any time; the first time that it is experienced the outlook will seem actually desperate.

Instantly the unfortunate man is overwhelmed by a sense of utter isolation, as though leagues and leagues of savage forest surrounded him on all sides, through which he must wander aimlessly, hopelessly, until he drops from exhaustion and starvation. Nervously he consults his compass, only to realize that it is of no more service to him now than a brass button. He starts to retrace his steps, but no sign of footprint can he detect. He is seized with a

panic of fear, as irrational but quite as urgent as that which swoops upon a belated urchin when he is passing a country graveyard at night. It will take a mighty effort of will to rein himself in and check a headlong stampede.

PANIC.—In such predicament as this, a man is really in serious peril. The danger is not from the wilderness, which, pitiless niggard though it be to the weak-minded or disabled, can yet be forced to yield food and shelter to him who is able-bodied and who keeps his wits about him. No: the man's danger is from himself.

I have heard old woodsmen say that there is no use in offering advice to novices about what they should do if they get lost, because a lost man is an insane man, anyway, and will remember nothing that has been told him. Certainly it is true that if a man in such a strait permits panic to conquer him, he is likely either to perish or to come out of the woods a gibbering lunatic. There have been many such cases. But it is not true that they are the rule. Thousands of wayfarers have been lost for a day, two days, or longer, without losing their self-command. And there really is no valid excuse for an able-bodied person going out of his head from being bewildered in the big woods so long as he has a gun and ammunition, or even a few dry matches and a jackknife. The first time I was lost, I was rattled and shook all over. Something seemed to tell me that camp lay in a certain direction, and I felt the same impulse to rush madly toward it that one feels to dash for the door when there is a cry of "fire!" in a theater. But I did remember what old Barnes had told me: "If you get lost, *sit down*!—sit down and give yourself half an hour to think it over." I sat down, and for five minutes could not think of anything, except cold, and rain, and hunger. Then

I got to drawing diagrams on the ground. Making no headway at this, I began considering how to pass the night if I remained just where I was.

This cleared my mind, robbed the woods of their spooks, and presently I was myself again. Then the actual situation flashed upon me. I saw just how I had got into this scrape, and knew that if I made a circuit of 200 yards radius I would strike the trail. Before this it had seemed at least two miles away. Well, I found it, all right. Had I listened to the demon of flight, in the first place, I would have plunged into one of the worst canebrakes in all Arkansas, and might have struggled there till I died—all within a mile and a half of my own camp.

I have been lost several times: in canebrakes, in flat woods of the overflow country, in the laurel, in fog, above the clouds (in the sense that I did not know on which side to descend from an *aiguille* or bare pinnacle of rock), and in caverns. The cave experiences were hair-raising, but the others were only incidents to chuckle over in retrospect, although I have scorched the back of more than one coat from lying too near a bivouac fire. A bad record, you will say, for one who assumes to tell others how to keep from getting lost! Well, maybe so; but the fact that I am still on deck may be some excuse for offering a little counsel as to what to do if you should get lost.

I do not think that one can get the best of wild life if he does not often "go it alone." Men who are interested in the guiding business may say otherwise. If one does go it alone, he may as well take it for granted that, sooner or later, he will get lost and have to stay out over night, or for several nights, alone. There is no man, white or red, who is not liable to lose his bearings in strange woods if he is careless. If an Indian is seldom at fault as to his course it is because he pays close attention to business; he does not lose himself in reverie, nor is his mind ever so concentrated on an object that he fails

to notice irregular or uncommon things along the way. And yet, even Indians and white frontiersmen sometimes get lost.

I have been with a first-class woodsman when he got mixed up on his own home hunting-ground—an overflow from the Mississippi, flooding sixty miles inland, had swept away old landmarks, replaced them with new ones, and changed the appearance of the country; then, subsiding, it had even altered the drainage of the land. At such a time the water of a tributary may actually run up-stream. In fog or snowstorm anybody can get lost.

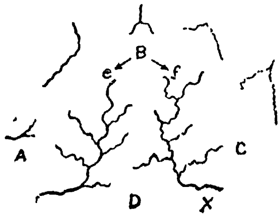


Fig. 1.—Following the Wrong Stream

You may take a professional guide from New Brunswick, let us say, or from Florida—it matters not where—place him in a new country where outlooks are few, and where the vegetation, the rocks and soil, and the general features of the country, are strange to him, and, if he does not get lost, it will be because he thinks more about avoiding it than he does about anything else.

Those who scout the idea of their ever losing bearings are such as have traveled little in strange lands, or have never ventured far without a native guide. Personally, I would rather get lost now and then than be forever hanging on to a guide's coat-tail. It is a matter of taste. Anyway, I shall never again have the willyjigs as I had 'em that first time, when I was actually within forty rods of a plain trail.

In the Mountains.—There is little excuse for getting lost, in fair weather, in a mountainous or undulating country where there are plenty of water-courses, unless one gets on the wrong side of a divide that separates two streams which do not run into each other. Thus, in Fig. 1, let *ABC* be a main

divide, *BD* a spur to the southward separating two streams that eventually flow in opposite directions, and let *X* be the location of the camp. A stranger who had spent the day on the upper mountains might return toward evening to *B*, and, thinking to follow the creek from *f* to *X*, might turn down at *e*, by mistake, and travel a considerable distance before he realized that he was going in the wrong direction.

FLAT WOODS.—In flat woods, where the watercourses are few and very meandering, the vegetation rank and monotonously uniform in appearance, and landmarks rare, a man may return within 200 yards of his own camp and pass by it, going ahead with hurrying pace as he becomes more and more anxious. In Fig. 2 a man leaves camp *X* in the morning, going in the direction indicated by the dotted line. He consults his compass at intervals during the day, tries to allow for his windings, and, returning in the evening, strikes the river at *Z*. If he follows its bank in either direction, he is likely to spend the night alone in the woods. If the camp were at *A*, and the homeward-bound hunter should reach the stream at *B*, he would be dumbfounded to find himself, apparently, on the wrong bank of the river.

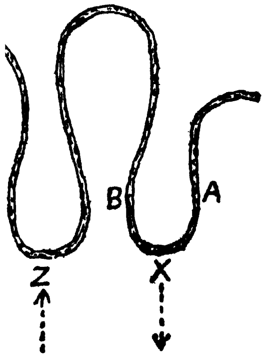


Fig. 2.—Ox-bow Bends

Another easy way to get bewildered is as follows: In Fig. 2 we will assume that the current runs from *A* toward *Z*, that a party unfamiliar with the river is descending it in a boat, and that one of the men leaves the boat at *A*, going ashore to hunt along the bank. At *X* he comes to the mouth of a deep creek, or some other obstruction, or he starts game that

leads him back into the woods. Not long afterward he reaches the river again at *Z*, and, after hallooing and firing a shot or two, but getting no answer, he hurries on down-stream, thinking that the boat got ahead of him while he was making his detour. The boat, meanwhile, has been rounding a great ox-bow curve, and may be a couple of miles behind the man ashore.

In each of these examples the country is assumed to be fairly easy to traverse, and in each case the misadventure might have been avoided by a little forethought. A bush bent over, here and there, a blaze on a tree where the underbrush was dense, would have saved all that. Without such precautions, there are places where a man can get badly muddled in a forty-acre tract. This is no exaggeration. One of my companions once was lost from early morning until after nightfall in a thirty-acre patch of blue cane. He struggled until almost completely exhausted, and when we found him he looked like a scarecrow. At no time had he been half a mile from the cabin.

THICKETS.—A canebrake is bad enough, but it is not so bad as those great tracts of rhododendron which, in the region between Thunderhead and the Balsam Mountains (Tennessee and North Carolina) cover mile after mile of steep mountainside where few men have ever been. The natives call such wastes "laurel slicks," "woolly heads," "lettuce beds," "yaller patches," and "hells." The rhododendron is worse than laurel, because it is more stunted and grows much more densely, so that it is quite impossible to make a way through it without cutting, foot by foot; and the wood is very tough. Two powerful mountaineers starting from the Tennessee side to cross the Smokies were misdirected and proceeded up the slope of the Devil's Court House, just east of Thunderhead. They were two days in making the ascent, a matter of three or four miles, notwithstanding that they could see out all the time and pursued the

shortest possible course. I asked one of them how they managed to crawl through the thicket. "We couldn't crawl," he replied, "we swum," meaning that they sprawled and floundered over the top. These men were not lost at all. In a "bad laurel" (heavily timbered), not very far from this, an old hunter and trapper who was born and bred in these mountains, was lost for three days, although the maze was not more than a mile square. His account of it gave it the name that it bears today, "Huggins's hell."

I could give many such instances, but these will suffice to show that there still is virgin ground in some of our oldest States. The far West and the far North present problems of their own. Extensive swamps are the worst places of all, above ground. As for caves, and how *not* to get lost in them, I will have something to say in another chapter.

WHAT TO DO.—No matter where, or in what circumstances, you may be, the moment you realize that you have lost your bearings, there is just one thing for you to do: *STOP!* Then sit down.

Now any man can remember that. It is a bit of "book learning" that no man can afford to despise. It is the one and only way to clear your wits, to drive off the demon of panic, and it is sure to help get you out of your predicament.

Then, if you are a smoker, light your pipe; if not, chew a twig. It won't take long for you to recover sense enough to know that if you stay right where you are until morning your companions, by that time, will be searching for you. They will be scouring the woods, hallooing, firing guns, scouting for your trail. Suppose you do have to stay out all night, alone in the woods; nothing will hurt you. The stories of bears or panthers pouncing on sleeping men are all tommyrot. So keep your shirt on.

How long has it been since you were where you *were* certain of your location? Probably not a long

time. Suppose you have traveled half an hour after leaving a known landmark. What is half an hour in the woods? A mile, say; perhaps not so much; for one does not keep up a steady jog in the wilderness; he often pauses to look or listen, and is bound to move slowly when off a beaten path.

But you don't want to stay here like a numbskull and face the sly grins or open ridicule of a searching party? Very well, the bugaboos are fleeing. Now take a stick, make a bare spot on the ground, and try to trace your probable course from the time of leaving camp to the time you first suspected you might be wandering astray. Mark on it the estimated location of such landmarks as you noticed. If you are not altogether a tenderfoot, you will remember how many streams or ridges you have crossed. Anyway, you will recall some features of the country you traversed. Not unlikely, when your mind has recovered its equipoise, you will be able to "backtrack" without much difficulty.

But in any case, no matter how confident you may be, *don't* take ten steps from the place where you are until you have marked it. If the location is favorable for a smoke sign (in flat woods it is of no avail) build a fire, with enough damp or punky stuff on it to keep up a smoke for a good while, and bank it with earth so it cannot spread. Or, blaze a tree on four sides—make big blazes that can be seen from any direction. Do this even though there be several hours of daylight ahead, and although you have no present intention of staying here; for you do know that this spot is only so many hours from camp by back trail, and that you may have good reason to return to it. This blazed tree, moreover, will be of great assistance to your camp-mates in searching for you, if you should not turn up later.

Then take note of the lay of the land around you, the direction of its drainage, the character of its vegetation, and the hospitalities that it offers to a night-bound traveler, in the way of drinking-water,

sound down-wood for an all-night fire, natural shelter, and browse or other bedding.

Now when you start out to recover the trail, make bush-marks as you go along (see Chapter III, Fig. 6); otherwise it will be the easiest thing in the world to lose the way back to that blazed tree.

In trying to pick up your old footprints don't give much attention to dry ground, except where there may be dusty places, or rocks where your hobnails might have left scratches. Look for tracks (I don't mean run around hunting for them) in the damp places that you pass, mossy spots, swales, margins of brooks, and for "scrapes" on the tops of fallen logs.

When searching for a trail, do not look close to your feet, but three or four yards ahead of you; for a faint trail is more readily seen at that angle than by looking straight down upon it. Cast your eyes also from side to side, bearing in mind what a trail should look like when you walk parallel with it, as well as when approaching at right angles.

If you get a shot at a squirrel or other animal (of course, you don't wander around looking for them) kill it and tie it fast to you. It is one of the little ironies of wilderness life that food may be extraordinarily scarce when you most need it—and that may be to-morrow.

But if you don't soon find that back track of yours, and if no familiar landmark shows up before the sun is within an hour of setting, *QUIT IT* for the day. It is high time, now, that you go right to work to make yourself snug for the night. Your success or failure to-morrow will depend very much upon what kind of a night's rest you get.

BIVOUACS.—In nearly every story that you read of a lost man's misadventures you find him struggling desperately on until black night shuts down. Then he throws his exhausted body upon the cold, damp ground, soon to awaken in bitter misery, and back himself up against a tree, to droop there through the long, long hours; or, the cold being intense, and

he without one dry match, the man totters crazily all night, 'round and 'round, to keep from freezing. What *could* he be fit for next day?

Of course, if the Swiss Family Robinson should get turned around in the forest primeval, they at once would find a shallow cave, a projecting ledge, a great hollow tree, or some other natural shelter ready-made on the spot. We often come across such natural harborages in the wilderness—when we don't need them. (Three of us hunters once spread our blankets inside a hollow cypress and had room to spare.) But no special providence looks after lost men.

It would be so easy to make a comfortable "one-night stand" if you had a knapsack of supplies on your back! Yes, you could get along very well if only you had a featherweight poncho, a 12-ounce tomahawk, and several big bites of grub (next time you go out alone you will have them). But to-day you just went off to one side after a crippled deer, or something, and your outfit comprises nothing but a gun and the contents of your pockets. Pretty prospect, isn't it?

"Under the greenwood tree,
Who loves to lie with me" . . .

is all very nice on a summer's day; but under the greenwood tree on a cold night in the big sticks, and the Lord knows where, with no *me* to share *who's* troubles—oh, darn Shakespeare!

Well, you must rustle. Just now you need four things.—

(1) Water.

(2) A fire that won't go out till morning.

(3) A windbreak to keep the other side of you warm.

(4) A bed to rest your bones and to keep off the chill of the ground.

And, my friend, you want to get these things with the *least expenditure* of time and effort. Night ap-

proaches; to-morrow may be a hard day. Besides, you are quite too tired already to waste the crook of your finger on non-essentials, while aimless pottering would be your ruin. The job must be tackled methodically.

So think back along your recent route and recall the best place where all four of those things you need are to be found—that is, the raw materials—and go to it.

I am assuming that the night is likely to be cold, but that there is no indication of rain or snow—that contingency will be considered later.

In a primitive forest there are big fallen trees on nearly every acre. Find a *sound* one that lies flat on level ground. You might use it either as a back-log or as a windbreak; the latter in this case, since you are to erect no shelter. In summer, a bed of dead leaves piled against the log, with a small fire in front, would be a good cubby for the night. But we assume that there will be frost.

Select the spot that you intend to lie on (leeward side of the log, of course), cover it with dry brush, and set it afire. The object is to dry out the ground and heat it. If the tree is not punky it will stand a considerable blaze close to it without igniting more than little spots on the bark, which can be extinguished with a handful or two of dirt. But don't, on your life, kindle a fire against a decayed or hollow log—you never could be sure of putting it out. If there are no sound down-logs, build an artificial windbreak of poles laid on top of each other and chinked with earth.

You first have raked the leaves together toward the center so that the fire cannot spread. Don't make too big a blaze at a time. When the ground you are to sleep on is burned off, keep a fire of small sticks going on it for half an hour, the length and width you are to occupy. Meantime you will be dragging in, and piling on one side, all the sound, dry wood you can get, for the night's fuel. Get

long sticks, as big as you can handle, and plenty of them. Perhaps there are some old pine stumps that you can uproot. Don't fool with soggy, decayed stuff. Probably the top of your fallen tree will furnish a lot of broken limbs that sprangle enough to have been kept mostly off the ground and have seasoned hard.

When you have plenty of night-wood piled up, take a pair of sticks and rake the embers of your brush fire forward to a place five or six feet in front of your bed. Build there your night fire. Tramp down all embers left by the first fire, and carefully extinguish any smoking spots on the tree. If the log does not quite meet the ground, chink the openings with dirt.

If there are evergreen bushes at hand, they make the best bedding (balsam, hemlock, spruce, in that order—even pine or cedar will do in a pinch). You won't have time to make a real browse bed (described in Chapter XIII of this book), but remember that the smaller the sticks under you, the better you will rest. If there are no evergreens, then use moss, ferns, grass, or whatever other soft stuff you may find. Dead leaves and pine needles are the last choice, as they are inflammable. If you have time, make that bed two feet deep.

The ground that you are going to sleep on is dry and hot, and will stay so a long time, being insulated by the bedding stuff. The log behind you is warm, and it will shield you from the wind. You have effected a double economy, because a small fire in front will suffice until the cold hours on the far side of midnight, for which time the bulk of your fuel is to be saved.

Don't fire any distress signals until shortly before dark; earlier ones would be attributed to some wandering hunter. But when the shadows begin to fall, and you have not shown up, your comrades will begin to grow uneasy and will listen for signals. The best signal with a gun is a shot, a pause of ten

seconds, and then two shots in quick succession. The first attracts attention, the others give the direction. If the men of your party hear you they will reply instantly. But if you hear no answer, do not try again for half an hour. *Save ammunition.* You will need it worse to-morrow, for signalling as you travel, and to get meat with.

If your camp-fire smokes badly, it is because it lies too flat on the ground for air to get under it. Build it on thick chunks, or on rocks if there are flat ones to be found.

So long as it does not rain, the problem of keeping warm without a blanket is not serious. If more covering is demanded, and there are enough small balsams in the neighborhood, one can make a deep bed of the browse, lay two or three poles over it, pile a lot of boughs on top, and then, by manipulating the poles, insinuate himself between the two layers. This will help very much to prevent too rapid radiation of the bodily heat. Another good kink is to get a number of stones, six to eight inches in diameter, heat them before the fire, and place them around you wherever the cold is felt. Have others heating in the meantime, and change from time to time. To lift and carry them, cut a small forked limb close to the joint, leaving two feet of each fork for handles, put the crotch over the rock, and press inward with the handles.

Perhaps, instead of a fallen tree, you may have the good luck to find a big uptilted rock with flat face, long enough to serve as windbreak, or a ledge, with enough level ground in front of it for your purpose. Rock holds heat a long time, yet generously radiates it. The warm air from the camp-fire will eddy around it.

A man without a blanket can bivouac in the way here described, and get a pretty good night's rest, even in freezing weather. If it snows, a browse bed-covering will help. But a chill fall rain is something else. Ugh! Maybe you can twist up enough

evergreen shrubs with your hands to build a kennel of some sort, but its slope must be steeper than 45° to do any good. If you find old logs from which sheets of bark can be peeled with a stick whittled wedge-shape at one end, you can make a pent-roof over your bed. Slope some sticks from the far side of the big log that serves as windbreak, forward over your bed, weight them down with rocks or a heavy stick, and shingle the bark over the upper ends. But you are in for a night of it—the best you can do—all for the lack of what "Nessmuk's" scoffers called his "limber-go-shiftless pocket axe." With the like of it you could build a good shelter of bark or of browse, such as will be described in a future chapter.

Among my most valued possessions is a tiny Collesser tomahawk, of 8-ounce head and 2½ inch bitt, which, with hickory handle and home-made sheath, weighs only three-quarters of a pound. I seldom go anywhere in the woods (unless in marching order with a heavier axe) without this little trick. It is all that is needed to put up a satisfactory shelter wherever there is hemlock or balsam, or bark that will peel, while for other service I use it oftener than I do my jackknife.

Fire Without Matches.—So far I have taken for granted that you have matches and that they are dry. Damp ones, by the way, may be restored by rubbing through the hair; or, place a match between the palms of your hands, with its head projecting a trifle, and roll it briskly back and forth; in a short time it will be dry enough to light.

But suppose you have no matches. Well, with a shotgun the task of making fire is easy; with a modern rifle, or pistol, that uses jacketed bullets, it is not so easy, because the bullet is hard to get out of the shell—still you can manage it by cutting lengthwise through the neck of the shell and prying the bullet out.

First make all preparations needed to ensure success when you get the flame. Build up your wood

ready to light, the kindling being stood up on end against the larger sticks in a half-cone shape, with opening at the bottom, in front, for tinder. This last may be very dry shredded bark, fine slivers of fat pine, or any dry splinters, pounded between two rocks until the fibers separate. In a rain you can get dry stuff from the inside of a hollow tree.

Worry the bullet out of the cartridge; sprinkle most of the powder (smokeless, I assume) on the tinder, leaving only *a few grains* in the shell. Then tear a bit of dry *cotton* cloth (lining from your clothing, for instance) with fluffy edges, and with this loosely fill the nearly emptied cartridge. Put it in your gun, and fire straight up into the air. The cloth will drop close to you, and either will be aflame or, at least, burning so that you can blow it into a blaze. Drop this quickly on your tinder, and the trick is done. Remember, you want only enough powder in the cartridge to blow the bit of rag a few feet into the air. Very little will do.

Sparks may be struck from flint, quartz, or pyrites, by striking a glancing blow with the back of a knife or other piece of hard steel. The chief difficulty is to *catch* the sparks. Hold the flint between thumb and finger of left hand, and some tinder in the hollow of the same hand. Tinder for this purpose is made by tearing (not cutting) cotton cloth into a long, narrow strip, and rolling it up like a roller bandage, but a bit spirally, so that the fluffy edge will overlay a little at each revolution, thus forming a nest of lint at one end of the roll, into which the sparks are to be struck. As soon as it catches, blow it into a flame.

The lens of a field-glass, or the outer lens of a camera, may do service as a burning glass; but it is another of the little ironies that the sun probably isn't shining when you get lost.

As for the fire-drill so dramatically exploited by popular lecturers, who make fire with sticks in less than a minute, it is all right provided you have the

right material, which must be soft, non-resinous wood, thoroughly seasoned, brash, but not the least punky. In most situations it would be accidental if a lost man should find such wood. As a matter of fact, savages carry their fire-sticks with them, as we do matches.

NEXT MORNING.—A night's rest, even though fitful, will have cleared your mind a good deal. By this time you probably will have a definite theory of location, based upon what you know of the relation of the camp site to the surrounding country, and the general course of your wanderings. And you will feel much better at having a whole day of sunlight ahead of you.

The first effort will be to get an outlook over the surrounding country. In the hills this is easy, but in a level country heavily timbered it is difficult. If you are a good climber, pick out a tall tree and go up as high as you can get. Where the trunks are too thick for climbing, select a big tree that has a slender one growing beside it from which you can clamber into the lower limbs of the old one. But don't risk a broken limb of your own—that might be fatal.

Having gained your outlook, note the compass direction of watercourses and other landmarks, mapping them on a piece of paper; for a lost man's memory is treacherous. The courses of small streams show where the main valley lies. Look for smoke. Your comrades will have raised one, if there be a woodsman among them.

Now decide whether to try to reach camp or to "break out" to a known road or settlement. If still completely bewildered, then there is but one thing to do: work *down country,* either along a stream or a divide. If you do this, even in a remote district, it cannot be more than a few days until you reach habitations of men. In the meantime you may suffer, but you certainly need not starve nor freeze. If you have no one definite objective, but are merely

going down country, do not try to steer a straight course, but save your strength by following the easiest way, being careful merely to keep the general direction. Follow divides, rather than streams, for reasons that will be given in the next chapter.

But we will assume that you have an idea which way camp lies. Take the compass direction from your outlook, note how the sun bears as you face that way, pick out a mark in line with the course, and steer for it— then from this to another, and so on. But, before leaving the site of your bivouac, blaze a tree and pencil on it the time of your start and the direction you intend to travel in. This will be invaluable to your mates if they track you up. At intervals of half an hour or so, fire a distress signal, if you can spare the ammunition—*don't waste it*.

As you travel, make bush marks and blazes along the course. It may be necessary to return; others can follow your trail by them; and, if you should circle, you will know it when you come across your old marks.

Circling.—When a man travels where there is no outlook over the surrounding country, he is apt to "circle." In going around obstacles he may choose habitually the same side, and not make enough allowance for this tendency when averaging up his windings. But many men have an unconscious *leaning* toward one side or the other, even in open country, even on horseback, and will tend to travel in a circle unless they frequently check their course by compass or landmarks. Just why, we do not know. It is said that only an ambidextrous man goes straight naturally. Most men swerve to the right, and, since most of us are right-handed, it may be that when there is nothing else to guide us we incline toward the stronger side.

I offer this explanation for what it may be worth. Anyway, the tendency to travel in a circle is common to most men when they are lost. Mr. C. C. Filson

says that a lost man once came to his camp who had walked continuously for six days and nights and was only about six miles from his starting point. Five hours of travel in any one direction would have taken him out of the woods and saved him the subsequent loss of both feet by freezing.

To avoid circling, one must travel by landmarks, or, where none are visible, as in thick woods, then by compass. Consult the instrument every two or three minutes, for a slight deviation, persisted in, soon swings you far aside. After going around an obstacle to the right, even up, by walking as far to the left. Don't travel too fast—it would excite you, wear you out, and keep you from marking your trail as you went along. Keep a stiff upper lip, and assure yourself that this is not a tragedy but only an interesting adventure—then it will turn out so.

How to live off the country, in case of being out a long time, will be discussed hereafter.

By the time you get out of this predicament you will agree that the art of *not* getting lost is worth studying. Let me now direct our attention to it.

CHAPTER III

PATHFINDING

I never knew a native of the wilderness who used a compass to guide him. The born backwoodsman relies upon the sun and stars, the direction of the wind, the courses of streams, prominent landmarks, and other natural signs of direction. That kind of pathfinding will be discussed later. It is essential in the education even of an amateur woodsman that he should learn to steer a course, over average ground and under ordinary conditions, without recourse to map or compass; for one can't be pottering over them when hunting or doing anything else of absorbing interest. Yet he should never be without them in the field; in emergencies they are simply invaluable.

On a windless, cloudy day, when boring through new country, especially if it be heavily timbered, it is quite too easy to lose one's bearings if the compass has been left behind. In thick fog or fast-falling snow, the best of men may go astray for lack of the faithful needle. Make it a rule, then, an iron rule, of wilderness life, never to leave your bed in the morning without compass, jackknife, and waterproof matchbox *filled* (fill it, as a matter of habit, every time you wind your watch). A small section of map showing the principal features of the country round about is another mighty good thing to have always on your person, no matter how you may be dressed for the day or what you may be intending to do. There is no telling when you may be called off on the keen jump, nor whither you may have to go.

For instance: one time a big buck ran right through camp while we were cooking dinner; in the flurry, everybody grabbed some other fellow's gun, somebody wounded the beast, and there was a long chase without the least preparation in the world. Again, we were all out picketing the mountain for a bear drive; the bear avoided all the likely crossings and slipped by within fifty yards of camp. Now suppose you had been left there as camp-keeper for the day. You snatch up a gun, fire, find blood on the trail, follow it a couple of hours, and then— "where are you at?"

Aside from their value in emergencies, the compass and map are particularly useful to *keep you out* of trouble. The best advice in the world is "Don't get lost." The only way to make reasonably sure of that is to mind your P's and Q's (or rather your *N* and *S*) in advance. For example:

Base Lines.—You have camped in a pleasant bit of flat-woods, on the margin of a stream, at *A* (Fig. 3). In the morning you decide to go out by yourself for a look-see, not hunting, of course, but just to get a good idea of the lay of the land. You know that the river runs north and south. Simplest thing in the world, then, to tramp eastward a couple of hours, and return in time for dinner. You can't cross that river without knowing it, and camp is right on the river bank, you know.

The forest is fairly open for the first mile or so and you steer an approximately straight course. Then you strike bogs and thickets, not bad ones nor big ones, but just enough to make you average your windings by glancing at the compass now and then. Presently the going is better, and you continue nearly straight east until you reach *B,* when it is time to return. You are sure that your course has been almost due east, and that you are about four miles from camp. You take compass bearings due west as far as you can see out, and back you go. But

you can't trail your own foot-prints. It would take one of Fenimore Cooper's redskins to do so over this firm ground covered with dry fallen leaves. No matter: you have a compass, haven't you?

Soon, at a point where your outbound course bore a bit northerly, you pass it, unknowingly, by going straight back west. You feel certain that you are steering right; for that compass is in your hand half the time.

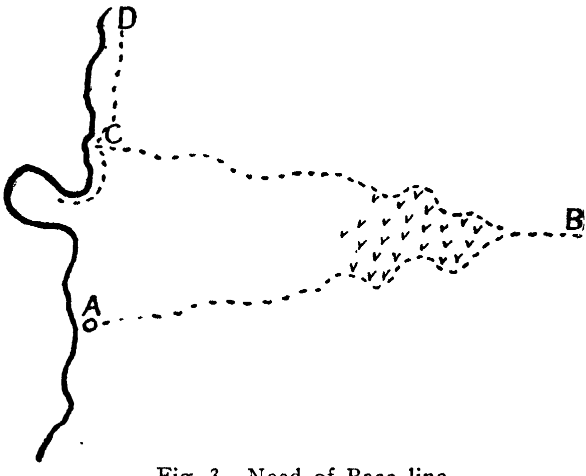


Fig. 3.—Need of Base line

Hang it! here is a bog. To the left it looks impracticable. You go around to the right, and then carefully even up the winding by swerving left an equal distance. Some lesser curves hereafter are allowed for in the same way. Finally you come out on the river. You *know* your return course has been very nearly due west. But the confounded river doesn't look a bit like it did at camp! You struggle to the bank through thick undergrowth, and when you get there you can't see two hundred yards of the stream in either direction. There is a jungle to the water's edge.

Well, you are either above or below camp. But which? Maybe old Leatherstocking could tell; but you can't, to save your life. You might as well pitch a penny for it. At random you turn downstream. Very soon you come to an abrupt bend going westward. There was no indication of such a bend close to camp. Probably the tents are upstream, you say. So you turn about-face and go north. Still an utterly strange river.

By one o'clock you realize that you are going wrong. Camp *couldn't* be so far off from where you struck the river. So you turn wearily back downstream, and, late in the afternoon you reach camp, feeling like a fool, and silently swearing never to tell a soul the true story of your misadventure.

This is one of the simplest cases of "bumfuzzlement" that I can think of. It might have been complicated by any of a hundred difficulties or mishaps that are common in the wilderness. Yet, simple as it was, it gave you no little anxiety and it ended in humiliation.

The trouble was that you started out in the wrong way. You should have explored a few miles of the river first. This would have given you a known *base-line,* to which you could return with perfect confidence from any direction. You could have marked that base-line with blazes every half-mile or thereabouts, on which were penciled the number of minutes' travel each location was from camp, the arrangement of blazes showing which way camp lay.

Where there is no river, road, or range of hills, running in a long continuous line to serve as base—nothing, say, but trackless forest—the first thing to do is to run such a line by compass, spotting the trees, as will be described hereafter. I am assuming, here, that camp is to remain in one place for some time.

Trail Making.—Various kinds of blazed trails will be described in the next chapter. There is a

way that I consider better for a man or a party venturing into strange woods where there are few if any old trails—better because it always shows which way camp lies, and because it takes much less labor than spotting trees so close together that the next blaze ahead can always be seen from the one preceding it. At such intervals as may be required, blaze a tree here and there along the course, with one spot on the side away from camp (Fig. 4) and two on the opposite side (Fig. 5). Even when a

Fig. 4.—One Blaze *A*-way from Camp

Fig. 5.—Two blazes *To*-ward Camp

man is bewildered he can remember "*A* blaze means *a*-way from, *two* blazes means *to*-ward."

A blaze with a hack below it (simply drive the hatchet into the bark and draw it out) is easier and quite as effective. And between the blazed trees, at such intervals that you can see one from another, or as circumstances may require, make bush marks (Fig. 6). A bush mark is made by bending over the top of a green and leafy bush in the direction you are going, snapping the stem (if necessary clipping it half through with knife or hatchet) but letting it adhere by part of the wood and bark so that the under side of the bushy top will "look at you"

when you return. The under side of the leaves, being of lighter shade than the upper, makes such a bush sign conspicuous in the woods. Marks like these can be made without slacking one's pace.

Where a bend in the trail is made, the blazes, instead of being opposite, should follow the bend, of course.

Blazing trees is prohibited on public lands, and the practice should be limited to remote regions where there are no regular trails. A blaze is everlasting, so long as the tree stands, and may cause trouble over land boundaries in years to come. Where underbrush is scarce, it may be necessary to spot the trees, but generally it will suffice merely to hack off a bit of the outer bark as big as your hand, without cutting into the sapwood.

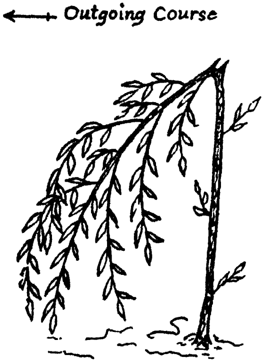


Fig. 6.—Bush Mark

The snow-laden limbs of low evergreen trees may droop so low as to conceal blazes on the trunks, and driving snow may cover them anyway, on any kind of tree. Consequently bush marks are more reliable than blazes in winter, if the snow is not too deep.

In average country, bush marks alone will suffice.

When going out on an old trail for the first time, make such a mark wherever you might be in doubt on the return, as where the trail forks, or where it is overgrown or faint. If there are no bushes, jab a stick into the side of the trail, sloping toward camp, or arrange a few stones in the form of an arrow-head, pointing the way.

Of course, such precautions as these are only to be taken on new ground, and then only according to circumstances. Nowadays our wilderness travel

is usually in regions where there are regular trails that are soon learned and which serve then as base-lines, or where mountains, streams, lakes, and other physical features are so prominent that it is easy to learn the lay of the land.

In thick woods, canebrakes, swamps, big thickets, and other places where the course is necessarily very tortuous, a compass is of little use while one is on the march. Wherever the traveler can get an out-look he fixes on some landmark in advance, notes how the sun strikes him when facing the mark, and thenceforth averages up his windings as well as he can. The compass is only of service when he can no longer see the sun, and is in doubt as to the direction he is traveling in.

In the wilderness one never knows when he may want to retrace his steps. Hence, when passing anything that has particularly caught his eye, let him turn and see how it looks *from the other side.*

ROUGH TRAVEL.—The way to find game, or to get the best of anything else that the forest hides, is not to follow well-beaten paths. One must often make his own trails, and go where the going is hardest. As he travels through the unbroken woods he may come, now and then, to a glade where the trees do not crowd each other, where the under-growth is sparse, and the view so unobstructed that he can see to shoot for a hundred yards in any direction; such spots may be about as common, relatively, as are safe anchorages and deep-water harbors along the coast. But part of the time, a wanderer in the forest primeval must pick a way for his feet over uneven ground that is covered with stubs, loose stones, slippery roots, crooked saplings, mixed down-wood, and tough, thorny vines. He is forever busy seeking openings, parting bushes, brushing away cob-webs, fending off springy branches, crawling over or under fallen trees, working around impenetrable tangles, or trying to find a foot-log or a ford. There is no such thing as a short-cut. It is beyond the

power of man to steer a straight course, or to keep up a uniform cadence of his steps.

Unless the traveler knows his ground there is no telling when he may come to a "windfall" where several acres of big timber have been overthrown by a hurricane and the great trees lie piled across each other in an awkward snarl. Or maybe there is an alder or spruce thicket or a cedar swamp in the way, or a canebrake or a cypress slough, or a laurel or rhododendron "slick," wherein a man will soon exhaust his strength to no purpose, if he be so unwise as to try to force a passage.

A *brule* or burnt-wood is a nasty place to pass through. Every foot of ground that is not covered by charred snags, or fallen trunks and limbs, bristles with a new growth of fireweed, blackberry and raspberry briers, young red cherries, white birches, poplars, quaking aspens, scrub oaks, or gray pines. Where the fire has occurred on one of those barren ridges that was covered with dwarfish oaks (post, black, or blackjack), the sharp, fire-hardened stubs of limbs protrude, like bayonets, at the height of one's face, menacing his eyes.

An old "lumber works," where the trees have been chopped out, leaving nothing but stumps, treetops, and other debris, grows up with the same rank tenants as a burnt-wood, and is as mean to flounder through. As a general rule, a mile and a half an hour of actual progress is "making good time" in the woods.

Crossing Streams.—If you have to cross a deep, rocky ravine or dangerous mountain stream by passing over a high foot-log or fallen tree, then, if the log is tilted at an uncomfortable angle, or if its surface is wet, or icy, or treacherous with loose bark, or if, for any reason, you fear dizziness or faintness, don't be ashamed to get down and straddle the log, and "coon it," hunching yourself along with hands and thighs. Let your companions laugh, if they will. It is not nice to break a limb when you are

in a country so rough that your comrades may have to pack you out, by each, in turn, carrying you on his own back and crawling with you.

Where there is no foot-log, a narrow stream may be crossed by using a jumping-pole, or, if it is too deep for that, by a rope or vine swung from an overhanging tree and doubled back.

Before fording, if the weather is cold, take off trousers and drawers and tie them to your pack, but keep your shoes on, lest you slip on smooth rocks. If the stream is swift, cut a stout pole, longer than yourself, with which to sound ahead of you and to brace yourself against the current by planting it downstream at each step.

In flat country the shallowest part of a stream is usually where the near bank makes the longest, sharpest point, and it runs diagonally toward a projection of the opposite bank, either up or downstream. The widest part of a river generally is the shallowest. The inside of a sharp bend is deep. In swift-flowing streams look for fords above the riffles.

Fording swift water is easiest with a heavy pack to help hold one down; but sling it so it will slip off if you stumble—otherwise it may drown you. Several men in company can cross a stream too swift for one at a time, if they cut a long pole and cross abreast, holding the pole horizontally in front of them with each man grasping it. The heaviest man should be on the downstream side.

To avoid mud and quicksand, look for pebbles on the bottom.

USE OF DIVIDES.—Rivers are often spoken of as having been man's natural highways in the days before roads. This was true only to a limited extent. A few great rivers such as the Hudson, the Ohio, the Mississippi, and the Missouri, were highways for down-stream travel, and smaller waterways were, and still are, used in summer in the *muskeg* country of the North, where land travel is imprac-

ticable until everything freezes up. But the general rule of aboriginal travel was to keep away from streams and follow the ridges between them. This rule still holds good when a party travels afoot or with pack-train in a country where there are no

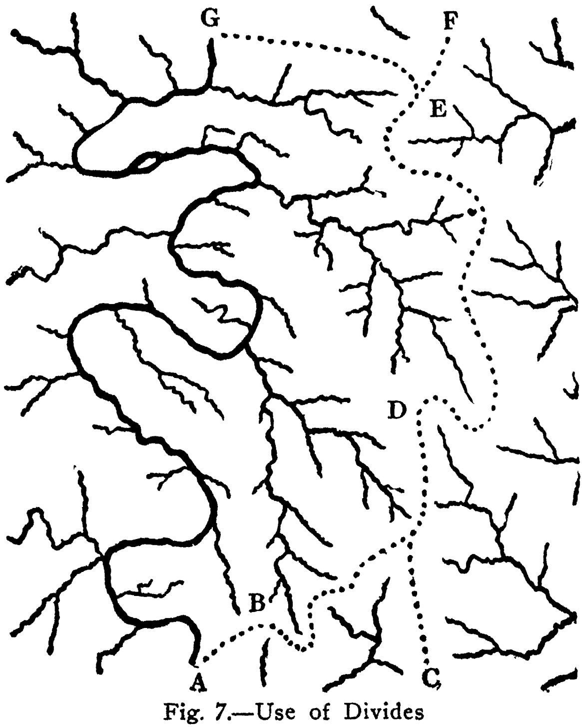


Fig. 7.—Use of Divides

bridges. A glance at the accompanying diagram (Fig. 7) will show why.

In this figure, *AG* represents a river, and *CF* the main divide or summit of watershed separating it from another river basin. It is assumed that a party afoot or with horses desires to advance from *A* to *G*. Evidently, if they try to follow either bank of the main stream, they will have many fords to make, not

only crossing tributaries here and there, but fording or swimming the main stream itself, many times, where cliffs, bogs, or impenetrable thickets make one of the banks impassable.

If the region through which the river runs is wide bottom-land, the mouths of its tributaries are likely to be deep, or to run over fathomless mud as dangerous as quicksand, and this will necessitate long detours. The vegetation up to the very bank of the river will be exceedingly rank, a wretched tangle of bushes, vines, briers, and tall grass, and fallen trees will be plentiful and large. At any time a heavy rainstorm may send the river out of its banks, and the party may find itself marooned where it can neither go forward nor backward. On the other hand, if the river runs through a mountainous country, it is probable that the travelers will come to a cañon that will compel them to retreat. In any case, the party will never have an outlook; it will never know what lies beyond the next bend of the river.

A comparatively easy way around all of these difficulties is shown by the dotted line *ABDEG*. Leaving the river by a ridge that leads to the main divide, and following the crest to a similar abutting ridge that runs down to the valley at the objective point, there will be no fords to make, the footing will be much better because vegetation is thinner on the more sterile, wind-swept heights, the fallen trees will be smaller, there will be no mud or quicksand or miry bogs, and every here and there a coign of vantage will be climbed from which a far outlook can be had over the surrounding country.

The chief precaution to be observed in trying to follow a divide where there is no trail, or where there are many intersecting trails, is not to stray off on some abutting ridge. Thus, at the points *B* and *D* there may be in each case a gap between knolls or peaks, and the lead to the left might easily be mistaken for the main divide. If the party were enticed

along either of these leads, on account of its trending in the desired direction, it would soon find itself in a *cul de sac.*

CELESTIAL GUIDES.—The sun by day and the stars by night are Nature's chief guides for the traveler. So long as the sun is visible anyone can tell, in a general way, the direction in which he is going. To find the sun on a cloudy day: hold a knife-blade or other thin, flat article perpendicularly on the thumb-nail, watch-case, or any glossy surface, and slowly twirl it around. It will cast a faint shadow, unless the day is very dark. Choose an open spot in the woods for this, rather than under the trees, and don't try it near noon, when little shadow would be cast anyway.

How to find the North Star is shown at the end of Chapter V.

CHAPTER IV

NATURE'S GUIDE-POSTS

SAMENESS OF THE FOREST.—All dense woods look much alike. Trees of most species grow very tall in a forest that has never been cut over, their trunks being commonly straight and slender, with no branches within, say, forty feet of the ground. This is because they cannot live without sunlight for their leaves, and they can only reach sunlight by growing tall like their neighbors that crowd around them. As the young tree shoots upward, its lower limbs atrophy and drop off. To some extent the characteristic markings of the trunk that distinguish the different species when they grow in the open, and to a greater extent their characteristic habits of branching, are neutralized when they grow in dense forest. Consequently a man who can readily tell one species from another, in open country, by their bark and branching habits, may be puzzled to distinguish them in aboriginal forest. Moreover, the lichens and mosses that cover the boles of trees, in the deep shade of a primitive wood, give them a sameness of aspect, so that there is some excuse for the novice who says that "all trees look alike" to him.

The knowledge of trees that can be gained, first from books and secondly from studies of trees themselves in city parks or in country wood-lots, must be supplemented by considerable experience in the real wilderness before one can say with confidence, by merely glancing at the bark, "that is a soft maple, and the other is a sugar-tree." And yet, I do not know any study that, in the long run, would be

more serviceable to the amateur woodsman than to get a good manual of American trees and then go about identifying the species in his neighborhood. Having gained some facility in this, then let him turn to studying peculiarities of individual growth. Such self-training, which can be carried out almost anywhere, will make him observant of a thousand and one little marks and characteristics that are sign-boards and street-numbers in the wilds.

WHAT TO NOTICE.—After a novice has had some preliminary training of the kind I have indicated, so that all things in the woods no longer look alike to him, he will meet another difficulty. His memory will be swamped! It is utterly impossible for any man, whether he be red, white, black, or yellow, to store up in his mind all the woodland marks and signs that one can see in a mile's tramp, to say nothing of the infinite diversity that he encounters in a long journey. Now, here is just where a skilled woodcraftsman has an enormous advantage over any and all amateurs. He knows what is common, and pays no attention to it; he knows what is uncommon, it catches his eye at once, and it interests him, so that he need make no effort to remember the thing. This *disregard for the common* eliminates at once three-fourths, yes, nine-tenths, of the trees, plants, rocks, etc., from his consideration; it relieves his memory of just that much burden. He will pass a hundred birch trees without a second glance, until his eye is riveted by a curly birch. Why riveted? Because curly birch is valuable. In the bottom lands he will scarcely see a sour gum, or a hundred of them; but let him come across one such tree on top of the ridge, and he will wonder how it chanced to stray so far from home. And so on, through all categories of woodland features. A woodsman notices such things as infallibly, and with as little conscious effort, as a woman notices the crumbs and lint on her neighbor's carpet.

THE HOMING INSTINCT (?)—We hear much

about the "innate sense of direction," the "extraordinary bump of locality," of savages and of certain white woodcraftsmen. "A good woodsman," we are told, "finds his way, just as an animal does, by a certain kind of instinct." If by this is meant that some men are born with a "gift," a sixth sense or homing instinct comparable to that of a carrier pigeon, I am more than sceptical. In the art of wilderness travel, as in other things, some men are more adept than others who have had equal advantages, and a few possess almost uncanny powers, amounting to what we call genius. To my notion this means little more than that some individuals are quicker to observe than others, reason more surely from cause to effect, and keep their minds more alert; and I believe that this is far more due to their taking unusual interest in their surroundings than to any marked partiality of Mother Nature in distributing her gifts. Instinct will work as well in one place as in another, but human "sense of direction" will not.

This is not saying that all men are born equal as regards the faculty of orientation; some have a knack; but that knack is not an instinct; it is worthless until sharpened and trained by experience.

Let me illustrate.—In the Great Smoky Mountains, which separate part of North Carolina from Tennessee, the "standers" in a bear drive are stationed along the main divide, or near it, at elevations of from 4,000 to 6,000 feet. We are out in all sorts of weather. The chase may continue from dawn until midnight, the bear perhaps running ten or fifteen miles through the roughest of all this rough country. At almost any time clouds may descend upon us, or ascend from below, and the fog, as we call it, is sometimes so thick that a man cannot see thirty feet in any direction. It may lift in five minutes, or it may continue for a day, two days, three days—there is no foretelling. It may be accompanied by drenching rain, or by a keen wind, or

may turn into a snowstorm; so we cannot sit around waiting on the chance of its rising.

Below the balsam zone (5,000 to 6,000 feet) the leaves, in autumn and early winter, lie very thickly upon the ground, so that a scurry of wind may at any moment obliterate the trail for some distance. When a cloud settles upon the mountain, a man hurrying along to get into the valley before nightfall, and over-confident, perhaps, of his bearings, may easily miss the trail and find himself on the wrong ridge—where? Once off the trail, there are no blazes to guide him, and the going gets worse and worse until it becomes damnable. If one could see out, he would not hesitate; but he cannot see a tree two rods away.

In such case, it is of serious import for a man to decide, rather promptly, upon which particular ridge he may have straggled; for many of these ridges are very thickety, some of them lead into laurel "hells," and on others one's progress is impeded by cliffs. To descend immediately into a creek valley would be the worst thing he could do, for the headwaters generally rise in almost impenetrable thickets of laurel and rhododendron, and their beds are rough and steep.

Now, what does a mountaineer do in such dilemma? Trust to instinct? Not a bit of it. Our strayed man might not be able to explain the process, he probably would not even be conscious of the infinitude of details involved, he might lay it all to "woods sense" and let you credit him with a mysterious "gift"; but this is what he would do: first, he would scan the trees and shrubs, closely observing their prevailing habit of growth; then he would examine the ground itself; he would move about like a dog scenting for a track; presently he would find evidence, not single, but collective—gathered from many sources—which his memory and reasoning powers would combine into a theory of locality, and, five times out of six, his theory would prove correct.

I have known a mountaineer, on a pitch-dark night, to identify the ridge he was on by feeling the trees; and there were no blazes on those trees, either.

Our mountaineers know the peculiarities and variations of their home hunting-grounds most thoroughly, so far as they relate to the hunter's and herdsman's arts, and from this intimate local knowledge they have gained certain general signs of direction that are fairly reliable throughout all the main ranges of the Southern Appalachians (mountains densely covered with more varied forest growth than any others in the world). So they have not the least hesitation about traveling into unknown parts for a week at a stretch, and without a compass, even though they may get into fog so thick that, as they quaintly say, "You could nigh stick your butcher-knife into it and hang up your shot-pouch."

But there is no dog-like or pigeon-like instinct about this. I can take one of these same men to the city of Boston and get him thoroughly lost within half a mile of his hotel. If he had the homing instinct he could find his own way back on the city streets; but he has not the ghost of such endowment. He is bewildered by the maze of things new to him, as a city man is in the forest. His attention is attracted to other things than signs of direction: so he goes astray.

NATURE'S GUIDE-POSTS.—There are two questions that woodsmen will argue, I suppose, until doomsday. Having given my views on one of them, I may as well tackle the other, and then have done with controversy. Are there any natural signs of direction that will give a man his bearings when the sky is obscured? Every one has heard, for example, that "moss grows thickest on the north side of a tree," and nearly every one has heard this as flatly contradicted. The general opinion seems to be that such signs are "important if true." The Indians and white frontiersmen of fiction never have any difficulty in finding their way by noting where moss

grows thickest on the trees; but when our novel-reader goes into the woods, compass in hand, and puts the thing to actual test, he probably will be disgusted to find that, in densely shaded primeval forest, there seems to be no regularity in the growth of moss, one tree having a thick layer of it on the north side, another on the east, another on the south, and so on. He is then ready to declare that the old saying is a "fake."

I shall endeavor to show that there is more in this matter than is generally credited. There are certain signs of direction that are fairly constant in given regions, so that by their help a native, or even a stranger who has good powers of observation, some patience, and a fair knowledge of the life habits of trees and plants, can steer his course without a compass, and without help from sun or stars. But let us clearly understand what is involved in this use of nature's compass-marks.

No universal rule can be established from such signs as the growth of moss on trees, the preponderance of branches on one side of a tree, or the direction toward which the tips of tall conifers point. Such things are modified by prevailing winds, shadows and shelter of nearby mountains, depth or sparseness of forest growth, and other local conditions. Everywhere exceptions will be found; if there were none, it would be child's play, not woodcraft, to follow such signs.

No one sign is infallible. A botanist can tell the north side of a steep hill from the south side by examining the plant growth; but no one plant of itself will tell him the story. So a woodsman works out his course by a system of *averaging* the signs around him. It is this averaging that demands genuine skill. It takes into account the prevailing winds of the region, the lay of the land, the habits of shade-loving and moisture-loving plants (and their opposites), the tendency of certain plants to point their leaves or their tips persistently in a cer-

tain direction, the growth of tree bark as influenced by sun and shade, the nesting habits of certain animals, the morning and evening flight of birds, and other natural phenomena, depending upon the general character of the country traversed. Moreover, in studying any one sign, a nice discrimination must be exercised. Let us glance at a few examples:

MOSS ON TREES.—First, as to the time-honored subject of moss—not confusing real moss with the parasitic lichens that incrust rocks and trees. Moss favors that part of a tree that holds the most moisture; not necessarily the part that receives the most moisture, but the part that *retains* it longest. Consequently it grows more abundantly on the upper side of a leaning tree than on the under side, on rough bark than on smooth bark, on top of projecting burls rather than on the lower side, and in the forks of trees, and on their buttressed bases. These factors are, of course, independent of the points of the compass.

Does it follow, then, that exposure has nothing to do with the growth of moss? Not at all. It merely follows that a competent woodcraftsman, seeking a sign of direction from the moss on trees, would *ignore* leaning trees, uncommonly rough bark, bossy knots, forks of limbs, and the bases of tree trunks, just as he would give no heed to the growth on prostrate logs. He would single out for examination the straight shafted old trees of rather smooth bark, knowing that on them there would be fairly even lodgment for moisture all around, and that the wet would evaporate least from the north and northeast sides of the tree, as a general rule, and, consequently, that on those sides the moss would preponderate. He would expect to find such difference more pronounced on the edge of thick forests than in their densely shaded interior. He would give special heed to the evidence of trees that were isolated enough to get direct sunlight throughout a good portion of the day, while those that were in

the shade of cliffs or steep mountains so that they could only catch the sunbeams in the morning or the afternoon would be ruled out of court.

You see how much more swiftly and surely such a man would reach a decision than could one who tried to take into account all kinds and conditions of trees, regardless of surroundings, and how much less he would have to puzzle over contradictory evidence. Among a hundred trees he might only examine ten, but those ten would be more trustworthy for his purpose than their ninety neighbors. This is woodcraft—the genuine article—as distinguished from the mysterious and infallible "sixth sense" of direction that, I think, exists nowhere outside of Leatherstocking Tales.

Tips of Conifers.—A rule that holds good in the main, wherever I have had a chance to study it, is that the feathery tip, the topmost little branch, of a towering pine or hemlock, points toward the rising sun, that is to say, a little south of east. There are exceptions, of course, but I have generally found this to be the case in three-fourths of the trees examined, leaving out of consideration those growing in deep, narrow valleys, or on wind-swept crests. I do not know whether it is characteristic of all conifers, throughout their ranges; but I commend this peculiar phenomenon to travelers, for observation.

Bark and Annual Rings.—The bark of *old* trees is generally thicker on the north and northeast sides than on the other sides. A more reliable indicator of direction, though one that a traveler seldom has opportunity to test, is the thickness of annual rings of wood growth, which is more pronounced on the north than on the south side of a tree. This has been noted in widely separated parts of the earth, and has been known for many centuries. More than four hundred years ago it was mentioned by Leonardo da Vinci, that universal genius who was scarcely less celebrated as an engineer and scientist than as an artist and litterateur. "The rings of

trees," wrote Leonardo, "show how many years they have lived, and their greater or smaller size shows whether the years were damper or drier. They also show the direction in which they were turned, because they are *larger on the north side than on the south,* and for this reason the center of the tree is nearer the bark on the south than on the north side." In 1893 this matter was put to a definite test by the New York State Forest Commission, which directed its foresters to examine the regularity of the northward thickening of annual rings in the black spruce of the Adirondacks. The foresters examined 700 trees, of varying exposure, noting in each case the compass-point toward which the longest radius of wood growth pointed. The result was:

North	471	South	1
Northeast	81	Southeast	0
East	106	West	27
		Southwest	6
Total north and east	658	Northwest	8
	94%		
		Total south and west	42
			6%

These figures deserve more than a passing glance.

COMPASS-PLANTS.—Some plants show a decided polarity in their habit of growth. The compass-plant or rosin-weed (*Silphium laciniatum*) that once abounded on the prairies of the Mississippi valley, from Minnesota to Texas, is a conspicuous example. It is a tall plant with long, stiff leaves, that do not grow horizontally but with their edges perpendicular. Its natural habitat is the open, shadeless prairie. If plants are examined that grow thus in the open, especially those in the little swales where they are not fully exposed to fierce winds, it will be found that the great majority of them present their radical leaves *north and south.* The large flower heads on short, thick stems point, like the hemlock's "finger," to the eastward, and show no such ten-

dency to follow the sun toward the west as is characteristic of many plants. I have often used the compass-plant as a guide, and never was led astray by it; in fact, the old settlers on the prairies, if they chanced to get lost on a dark night, would get their bearings by feeling the leaves of the compass-plant.

The closely related prairie dock (*Silphium terebinthinaceum*) and that troublesome weed known as prickly lettuce (*Lactuca scariola*), show a similar polarity. This characteristic is lost if the plants are grown where they receive much shade. Of course, terrestrial magnetism has nothing to do with the polarity of plants; it is the sunlight, received on the two sides of the leaves alternately, that determines their position.

But what think you of plant *roots* that persistently grow north and south? The woodsmen of the Great Smoky Mountains declare that there is a "north-and-south plant," as they call it, with two long roots that grow respectively north and south. Doctor Davis of Ware's Valley, on the Tennessee side described it to me as follows: "It resembles wild verbena, grows thigh-high, is a rare plant, and generally is found in hollows on the south side of mountains, in rocky neighborhoods, near trickling streams. Its leaf is serrated, 1½ by 1 inch, or larger, with purple heart, yellow edges, and the rest a bright red. Its roots usually do grow north and south. The plant is one of the most valuable medicinally that I know of, particularly for syphilitic affections. I do not know it by any other name than the native one of North-and-South. I gather it when I can find it, and use it in my practice." Many others have given me similar reports. I do not know the plant; have never hunted systematically for it.

Lost Arts.—I am of the opinion that there are natural compass-signs in the forest, and on the plain, that we are ignorant of, but that were well known to savages in a state of nature. Such men, depend-

ent from childhood upon close observation of their environment, but observation urged by entirely different motives from those of our naturalists, and directed toward different ends, would inevitably acquire a woodland lore different from ours, but quite as thorough in its own way. That they should develop keen perceptive faculties is no more remarkable than that a carpenter should hit a nail instead of the thumb that steadies it. That they should notice and study signs that no modern hunter or scientist would bother his head about is a matter of course. Unquestionably we have lost many arts of wildcraft that were daily practised by our ancestors of the stone age, just as we have lost their acquaintance with the habits of animals now extinct. Probably no white man of the future will ever equal Jim Bridger as a trailer; and it is but natural to suppose that Bridger himself had superiors among the savages from whom he learned his craft. It is a superficial judgment to rate as an old-wives' tale every story of exploits in the past that we cannot at present duplicate. However, we need not go to novelists to find out how such things were done. There is much pleasure to be gained in seeking to recover some of the lost arts of a primitive age; and, I believe, some profit as well.

But facts such as I have cited regarding the compass-signs of the woods are of practical value only to men who spend much of their time in the forest, rely wholly on themselves as guides, seldom or never use instruments, and so have their perceptive faculties sharpened beyond any keenness that average sportsmen are likely to acquire. Carry a compass.

CHAPTER V

BLAZES—SURVEY LINES—USE OF THE COMPASS

The chief difficulty in forest travel, especially in flat lands that are heavily timbered, is the lack of natural outlooks from which one could get a view of distant landmarks. Although there are plenty of marks in the woods themselves by which a trained woodsman can follow a route that he traversed not long before, yet these signs are forever changing, vanishing, being superseded by others. Not only do new growths spring up, but old ones are swept away, sometimes suddenly, as by flood or fire. Hence, when men have once picked out a course through the woods that they intend to follow again, they leave permanent marks along the way for future guidance. The most conspicuous and durable waymarks that can easily be made are blazes on the trees. It is of no little consequence to a traveler in the wilds that he should know something about blazes and the special uses made of them in the backwoods.

BLAZES.—On a thin-barked tree, a blaze is made by a single downward stroke, the axe being held almost parallel with the trunk; but if the bark is thick, an upward and a downward clip must be made, perhaps several of them, because, in any case, the object usually is to expose a good-sized spot of the whitish sapwood of the tree, which, set in the dark framework of the outer bark, is a staring mark in the woods, sure to attract attention, at least while fresh. Outside of white birch forests, white is the most conspicuous color in the woods, until snow falls.

If a blaze is made merely on the outer bark, it will not show so plainly by contrast. This kind of blaze, however, may be preferred for some purposes; for example, by a trapper who does not want to call everybody's attention to where his traps are set. A bark-blaze has the peculiarity that it lasts unaltered, so long as the bark itself endures, preserving its original outlines and distinctness, no matter how much the tree may grow. But if a wound, however slight, be made through the bark into the sapwood of the tree, so that the sap, which is the tree's blood, exudes, a healing process will at once set in, and the injury, in time, will be covered over. So, as soon as a blaze is made that exposes the wood, the tree begins at once to cover up its scar. This is a slow process. First the edges of the cut will widen, then a sort of lip of smooth new inner bark will form, and this will gradually spread inward over the gash. Once this new skin has formed, the wound will be covered by new annual layers of wood, as well as by new outer bark. Years after the blaze was made, nothing will show on the surface but a slight scar, a sign that takes practised eyes to detect and read.

A blaze always remains at its original height above the ground, and, where two or more spots have been cut in the same tree, they will always stand at the same distance apart. This is because a tree increases its height and girth only by building on top of the previous growth, not by stretching it.

Age of Blazes.—The age of a hack or blaze in a marked tree is determined by chopping out a billet of the wood containing the mark and counting the annular rings of growth from bottom of scar outward, allowing one year for each ring. In counting annular growth, some begin with the first soft lamina (porous part of year's growth), jumping the first hard layer, to the second lamina, and so on. It is more accurate to count the hard strata, for the following reasons: Soft laminae are formed in the spring, when the sap is rising. If a hack is made

at that time it may not show until a hard ring forms over it the next fall or winter, when the sap is down. If the season has been very dry, there may be two runs of sap, hence a double soft ring that year. A mark made in wood when the sap is down (after the fall of leaves) can have its age determined very positively, but if made when the fresh sap is up it may be hard to say whether the mark goes through that year's growth or only to it.

On some kinds of trees, if a blaze goes through to the sap wood, the scar on the bark is hard to identify as an ax mark, because the wood, in growing, spreads it.

The age of an axe mark is hard to determine in birch, and impossible in tupelo or winged elm, owing to irregularity of fiber.

A blaze on a frozen tree makes a bad wound.

A mark on the sheltered side of a tree does not look nearly so old as one opposite, because moisture accumulated makes the bark rot off from the weather side.

Blazes on the bark of chestnut, tulip poplar, young white oak, many locusts, and some other trees, are not apt to be permanent because these trees shed their bark more or less and do not retain marks so well as beech, black birch, Spanish oak, mountain oak, and other close-barked trees. Bark that scales does not hold moss.

FOLLOWING A LINE.—Most old woods trails are blazed on only one side of the tree, the side facing the trail, so as to be seen from either direction. Spotted trails (opposite sides blazed as previously described) are seldom made by professional woodsmen except where there is unusual danger of losing the way.

An old line of blazes on spruce or pine trees is much easier to follow than if made on non-resinous trees, because the resin deposited by the oozing sap leaves a very noticeable and durable mark. Similarly, when an inscription has been penciled or

painted on a fresh blaze on a pine tree, the sap glazes over the mark and makes it almost imperishable.

In searching out a line of blazes, one should keep his eyes glancing horizontally along a plane about breast-high, because that is the height at which surveyors leave their marks, and others usually follow the custom, unless the line has been spotted by a man on horseback, or from a boat during time of overflow.

When a blazed line turns abruptly, so that a person following might otherwise overrun it, a long slash is made on that side of the tree which *faces* the new direction.

It is difficult to follow a line of blazes when snow is falling, because the wind drives the damp flakes against the tree, where they adhere, and must be brushed away to find the blaze.

Now, it is often of much consequence to a traveler to remember such facts as these. For example, there is nothing more common in the annals of misadventure than for a novice to stray off on a deer trail, or, in southern forests, on a cattle trail, which, although seductively plain at first, leads nowhere in particular and soon dwindles to nothing. When undecided, look for blazes along the path. In heavily timbered regions, such as we are now considering, any trail that is, or ever has been, used as a highway by white men is likely to have been blazed.

Again, it is often of moment to determine, when one strikes a strange trail, what its nature is—for what purpose it was made—and thus be able to figure out whether it is likely to lead directly to a settlement or camp. This ought not to be very difficult when one knows what classes of men have preceded him in this particular forest. Generally speaking, a line spotted in a wide forest that as yet has no farmers' clearings is likely to have been made by either (1) a trapper, (2) a lumberman or timber-looker, or (3) a surveyor.

A TRAPPER'S LINE usually leads from one stream

or lake to another. The blazes are likely to be inconspicuous. The line probably meanders a good deal, but not to escape ordinary obstacles, not disdaining a steep climb for a short-cut. Along its course, at intervals of eight or ten miles, there are probably rude shanties containing supplies or the ruins of such shacks, if the line is no longer used. Such a line does not lead to any settlement, and can seldom be of any use to a wayfarer.

A LUMBERMAN'S LINE.—Timber-lookers may or may not leave evidence of their wanderings—more likely not, for, like other seekers after bonanzas, they may have excellent reasons for not doing so. At most, they would merely mark the easiest route for a prospective road from the river to some "bunch" of timber. Where logging operations have already begun, then, wherever a stump stands it will not be hard to determine the direction in which the logs were twitched to the nearby "lizard road," where they were loaded on lizards (forks of timber used as sleds), or on wagons, and dragged to the river or saw-mill. (I am assuming primitive operations in a remote wilderness.) The lizard road was blazed when first laid out. Logs are never dragged uphill if that can be avoided; consequently the trend of the road will be downhill, or on a level. The lizard road will show ruts, trees barked along the way by whiffle-trees, and other characteristic marks. Wherever there is a bridge or a corduroyed road the timbers will be worn most on the side opposite the camp, because heavy loads were drawn toward camp, not away from it. Once the old lumber-camp site is reached, even though it be long deserted, the signs of an old "tote road" can be discerned, leading toward a settlement from which supplies were transported.

A SURVEYOR'S LINE is absolutely straight (with exception noted below). When it reaches an impassable obstacle, such as a swamp or a cliff, an offset is made to right or left; but this offset is also

a straight line, at right angles, of course, to the main one, the latter being continued in the original direction as soon as the obstacle has been passed. For this, and other reasons that presently will appear, a surveyor's line can never be mistaken for any other.

Surveyors are careful to space their marks more uniformly than hunters and trappers and loggers. They cut rather square into the tree, at right angles, so that the weather may not wear away the marks nor the tree become diseased and so obliterate them.

OLD SURVEYS.—The old states of the East and South were surveyed before there were any Government regulations for such work, and had methods of their own for marking lines and corners, varying from place to place. In the rougher regions such work was likely to be slipshod. Old-time surveyors in the mountains often ran lines that were winding, because they had no flagmen to keep the line straight. It was difficult to keep sight marks. Measurements often were inaccurate. The chain was likely to go too low up a ridge and too high in crossing hollows. Mere surface surveying was practised over logs, rocks, etc. Chains were intentionally made overlength to allow for this.

The practice of measuring by half-chains in rough country led to many errors of counting, by dropping a link, and so on. Few of the old surveyors were careful about variations of the compass. In fact, I have known backwoods surveyors who were ignorant of the change in magnetic meridian.

MODERN SURVEYS.—Throughout most parts of the West, the method of numbering, subdividing, and marking township sections is that adopted by the public land surveys, a brief description of which is given below. If one understands the merest rudiments of public surveying, and has a township map of the locality, then, whenever he runs across a section line, he can soon tell exactly where he is, and what is the most direct route to any other point in the neighborhood.

It is common practice, wherever a regular trail crosses one of these lines, to square or face on four sides a tree or two standing close by, drawing the traveler's attention to the line. These survey lines may be of practical use to him in various ways. By them he can determine exactly the position of his camp with reference to the surrounding country. He can locate any point that he desires to visit or revisit, such as a cache, a mineral deposit, a piece of land that he may wish to purchase, and so on. If he gets lost, it is somewhere within half a mile, or less, of a survey line, which will take him to a marked corner from which he can learn his position.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Fig. 8.—Plan for Numbering Sections of a Township

Township and Section Lines.—The public lands of the United States are divided into townships, usually of six miles square (23,040 acres), as nearly as convergence of meridians allows. A township is sub-divided into thirty-six sections, each one mile square, as nearly as may be, which, as a general rule, are numbered as shown in Fig. 8, and are legally subdivided as indicated in Fig. 9.

Starting from an established corner, all trees that stand directly on the line of survey have two chops or notches cut on each side of them, without any other marks whatever. These are called "sight trees" or "line trees" (sometimes "fore and aft trees"). Since there may not be enough trees actually intercepting the line of sight to make such a line conspicuous, a sufficient number of other trees standing within not more than two rods of the line,

on either side of it, are blazed on two sides diagonally, or quartering toward the line, or coinciding in direction with the line where the trees stand very near it. Blazes are not omitted where trees two inches or more in diameter are found on or near the line.

Where trees are scarce, bushes on or near the line are bent at right angles therewith, and receive a blow with the axe at the usual height of blazes from the

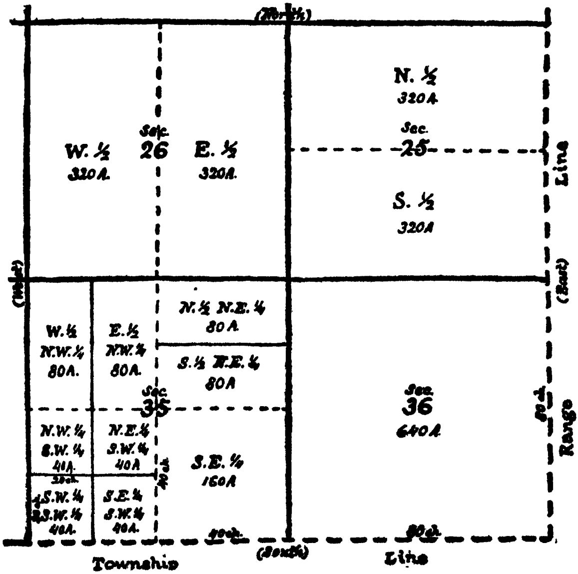


Fig. 9—Subdivision of Sections

ground, sufficient to leave them in a bent position, but not to prevent growth.

When the course is obstructed by swamps, lakes, or other impassable objects, the line is prolonged across by taking the necessary right angle offsets, or by traverse, etc., until the line is regained on the opposite side. At the intersection of lines on both margins, a post is set for a witness point, and two trees on opposite sides of the line are here marked

with a blaze and notch facing the post; but on the margins of navigable rivers or lakes the trees are marked with the number of the fractional section, township, and range. Arabic figures are used exclusively.

Corner Marks.—The following corners are marked:

(1) For township boundaries, at intervals of every six miles.

(2) For section boundaries, at intervals of every mile.

(3) For quarter-section boundaries, at intervals of one-half mile (with exceptions).

(4) Meander corners, wherever lines intersect banks of rivers, etc., directed to be meandered.

Witness corners bear the same marks as those of true corners, plus the letters *W. C.*

Four different modes of perpetuating corners are employed, in the following order of choice:

(1) Corner trees, when a tree not less than five inches in diameter stands immediately in place.

(2) Stone corners, where procurable. These must be at least 14 inches long. Stones 14 to 18 inches long are set two-thirds and larger ones three-fourths of their length in the ground.

(3) Posts and witnesses. The latter are trees adjacent, in opposite directions, each with a smooth blaze facing the corner, with a notch at the lower end, and with the number of township, range, and section; below this, near the ground, on a smooth blaze are marked the letters *B. T.* ("bearing tree"). Blazes may be omitted from smooth-barked trees. Where there are no trees, witness pits are dug, two feet square, and at least one foot deep.

(4) Posts and mounds. A mound is erected around the corner post, and a marked stone, or some charcoal, or a charred stake, is deposited a foot below the surface on the side toward which the line runs.

Township Corner Post.—This projects two feet above the ground, the projecting part being squared.

When the corner is common to four townships, the post is set cornerwise to the lines, and on each flattened side is marked the number of the township, range, and section, thus: *T.* 1 *S.; R.* 2 *W.; S.* 36.

This example reading "Township 1 South, Range 2 West, Section 36." *Six notches* are cut on each of the four edges.

If the post is on a closing corner, where the line does not continue straight ahead, but is offset to allow for convergence of meridians, this closing corner being common to two townships south of the base line, six notches are cut on each of the east, south, and west sides, but none on the north, and *C. C.* ("closing corner") is cut on the surface.

The position of *all* township corner posts is witnessed by four "bearing trees," or pits, or stones. Bearing trees are marked like the post; stones are merely notched.

Section Corners.—When the corner is common to four sections, the post is set cornerwise to the lines, the numbers of sections being marked on the surfaces facing them, and on the northeast face the number of township and range is inscribed. All mile-posts on township lines have as many notches on the two corresponding edges as they are miles distant from the respective township corners. Section posts in the interior of a township have as many notches on the south and east edges as they are miles from the south and east boundaries of the township, but none on the north and west edges. All section posts are "witnessed" as above. Section corner stones are merely notched.

Quarter-section Corners.—These are merely marked ¼ and "witnessed."

Red chalk is used to make marks more conspicuous.

USE OF THE COMPASS.—In Volume I (pp. 168-169) some advice was given as to selecting a compass. Let me repeat that it should be of hunting case pattern, not only because an open faced one

is easily broken, but because a cover helps to exclude dust and moisture. The least moisture under the glass will cause the needle to stick (if dampness gets inside anyway, dry the compass by a gentle heat: too much heat will destroy the magnetism). And there is another reason: the friction of one's pocket on the glass of a compass may magnetize it and attract the needle (touching the glass with a wet finger will remedy this).

You may have a pocket compass of surveyor's pattern, such as the common military compass in a square wooden box, used in our army. Observe that on a surveyor's compass the *E* and *W* marks are transposed, and don't let this fool you in the field.

In using a compass look out for local attraction. Put your gun or axe aside; a knife, or belt buckle, or other piece of metal may deflect the needle. If there is anything in your equipment that might do this, test the instrument first on the ground a pace away, and then in your hand. The compass should not be kept near iron, even when not in use, as the needle is likely to be demagnetized.

A compass needle may be demagnetized when traveling in an electric car if carried in a valise or knapsack and set down on the floor over a powerful motor, if the needle is clamped, as it should be when not in use. To strengthen the magnetism of a compass needle, unclamp it and lay the instrument near a motor or generator or strong magnet; then, when it has stopped quivering, clamp it again and leave it under the influence of the magnetic current for a short time.

A compass may become bewitched by a body of ore that you may be passing over, but such experiences are rare. If you suspect something of the sort, carry the instrument away, it need not be far, and test again. You are far more likely to be bewitched yourself.

THE COMPASS IN CAMP.—No compass can tell

you which way camp lies when you are lost. So the first and best place to use it is in camp, before you go anywhere. If there are landmarks visible from camp, take their bearings, and locate them on a sheet of paper or in your notebook. Then, if you are in a flat country, run a base-line as described in Chapter III. If in a hilly region, climb the nearest height, and from it make a sketch map of the surrounding country, with streams and prominent landmarks noted and their bearings shown. Carry that map always with you, and add to it as you learn the country. No matter how rude it may be, it is likely to come in mighty handy.

An experienced woodsman may photograph the landscape on his brain, but not one city man in a hundred can do so with certainty that it will not have blurred or faded away when he gets bewildered. So don't let any false modesty keep you from using your pencil: the man who laughs at an amateur (or anybody else) for doing so is most likely a Reub who never has been a hundred miles from his own front door.

Keeping a Course.—When traveling in a region where there are plenty of outlooks, the weather being clear, the sun and visible landmarks are sufficient guides. When you do use a compass on the march, and the country is not too difficult, it will be enough to hold the instrument in one hand, and, without waiting for the needle to stop swinging, note the point midway of the limits of its motion and take that for north, unless the magnetic declination is considerable (see below).

In level, heavily timbered country, one must take greater pains if he wants to reach a definite point. Lay the compass on the ground, or on any higher object that will hold it level. Or, if both hands are free, hold it in both of them at half-arm's length, with elbows resting on your sides, so as to bring the instrument straight in front of the center of your body. Then face some tall tree or other conspicu-

ous feature of the landscape in direct line with your objective and as far off as you can see. Check the vibration of the needle by quickly tipping the compass until the end of the needle touches the glass, and repeat until needle stops quivering. Now level the box and take the bearing of your landmark. Walk to it, and take a sight on something else in the same line.

Where you cannot see out to take bearings in this way, consult the compass every two or three minutes; for it is the easiest thing in the world to get off a true course at such times, and a few degrees' swerve, if not soon detected, will carry you far astray.

When some obstacle obliges you to make a detour, sight some landmark ahead, if you can, before you go around. If there be none visible, then estimate your winding with great care, and get back in line again as soon as you can. It is rarely the case that one can travel any distance in the wilderness without swerving very often from a true course; so the art of averaging windings should be practiced until one becomes adept.

When following a stream, note how many tributaries you cross. When following a divide, note how many abutting ridges you pass on each side. You will need that knowledge when you return, and it must be *exact.*

MAGNETIC VARIATION.—The north end of a compass needle *does not point to the true north,* except in certain places as noted below. It points to the *magnetic pole,* which lies far south of the north pole and about seven degrees west of the meridian of 90°W.

The places where a compass does point to the geographic north are those situated along what is called the "agonic line," or "zero curve," or "line of no variation." This is not a straight line from north to south like a meridian on the map, but has many waves and loops, and runs in the main easterly

of south. At present the agonic line runs from Mackinac Island, in Lake Michigan, loops west and then diagonally through eastern Michigan to central Ohio, makes a big loop north toward Lake Erie and back, south to the Ohio River, makes two big loops east and west in eastern Kentucky, runs south through western Virginia, loops west in eastern Tennessee and then far back east, goes down through western North Carolina, loops east again, and then runs diagonally down through Georgia and out into the Atlantic. This line is not stationary, but has a slow movement westward called the "annual change." Nobody knows the cause of these vagaries: magnetic variation is a mystery as yet unsolved.

Now note this: at *all places east* of the agonic line the north end of a compass needle *points to the west* of true north (more and more as the distance increases), and everywhere *west* of this line it *points easterly*.

For instance, at New York City the compass now points 10°W; at Eastport, Me., 20°W; at Lincoln, Neb., 10°E; at Helena, Mont., 20°E. This "declination" or "variation of the compass" must be allowed for when running a true course, or when plotting one by map.

A line passing through all places that show the same compass variation is called a "line of equal magnetic variation." Such lines do not by any means run straight like meridians, but are wavy and looped and run off at strange angles, like the agonic line, though none of them correspond to its meanders; and they, too, shift slowly westward from year to year.

Now for the practical application. Suppose you are on the line of magnetic variation that runs through Ogden, Utah, where the declination is 18E°. To find true north, you set your compass so that the needle points 18°E, as in Fig. 10. Then the *N* mark on the dial points due north.

To lay out a course by map: spread the sheet out

flat and lay the compass on it with *N-S* line of dial exactly parallel with *N-S* line on map. Then revolve map until needle shows proper number of degrees allowance for local variation, if any. All meridians on the map will then be parallel with the lines they represent on the ground. Now you can take the bearings of your objective, and if the instrument has a movable course arrow (see Vol. I., p. 169) set it accordingly.

The following table of declinations, prepared by the U. S. Coast and Geodetic Survey, is copied from the *World Almanac* of 1916. By adding or subtracting, as the case may be, the "annual change" multiplied by the number of years after 1916, you will get a close approximation to the variation for a future date, although the annual change is not constant.

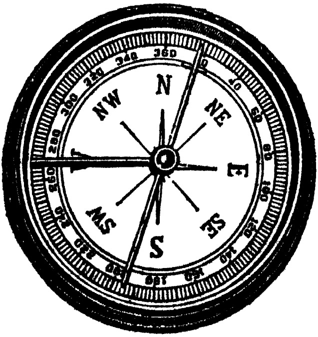


Fig. 10.—Compass Variation

MAGNETIC DECLINATIONS

Or Variations of Compass for January, 1916—With the Annual Change between 1910 and 1915 for the Principal Places in the United States

State or Territory.	Station.	Variation January, 1916 ° ′	Annual Change. ′
Ala....	Montgomery....	2 51 E	+1
	Mobile.......	4 45 E	+1
	Huntsville.....	3 59 E	0
Alaska.	Sitka.........	30 25 E	+2
	Kodiak........	24 00 E	—2
	St. Michael....	21 12 E	—4
	Dutch Harbor..	16 40 E	—4
	Kiska.........	7 12 E	—5
Ariz....	Prescott.......	14 45 E	+3
	Yuma.........	14 51 E	+4
	Nogales.......	13 34 E	+4
Ark...	Little Rock....	7 00 E	+2
Cal....	Sacramento....	17 24 E	+3
	San Francisco..	18 09 E	+3
	Los Angeles....	15 55 E	+3
	San Diego.....	15 26 E	+3
Col...	Denver.......	14 45 E	+3
Conn..	Hartford.......	11 44W	+6
	New Haven....	11 13W	+6
Del....	Dover........	7 42W	+5
Dist. of Col..	Washington....	5 50W	+4
Florida.	Tallahassee....	2 20 E	0
	Jacksonville...	0 58 E	—1
	Key West.....	2 30 E	0
Georgia	Atlanta.......	1 33 E	—1
	Savannah.....	0 19 E	—2
Idaho..	Boisé.........	19 48 E	+3
Illinois.	Springfield....	4 18 E	0
	Chicago.......	3 35 E	—1
Indiana	Indianapolis...	0 59 E	—1
	Fort Wayne...	0 13W	+2
Iowa...	Des Moines....	8 03 E	+1
	Keokuk.......	6 03 E	0
Kansas.	Topeka.......	9 32 E	+2
	Ness City.....	11 40 E	+2
Ky.....	Lexington.....	0 13 E	—1
	Paducah......	4 24 E	0
	Louisville.....	1 11 E	—1
La.....	Baton Rouge...	6 14 E	+2
	New Orleans...	5 45 E	+2
	Shreveport....	7 30 E	+2
Maine..	Bangor.......	18 25W	+6
	Portland......	15 55W	+6
	Eastport......	20 37W	+6
Md....	Annapolis.....	6 31W	+4
	Baltimore.....	6 42W	+4
Mass...	Boston........	14 00W	+6
	Pittsfield......	12 21W	+6
Mich...	Lansing.......	0 42W	+2
	Detroit.......	1 55W	+3
	Marquette.....	1 51 E	—2
Minn..	St. Paul.......	8 50 E	0
	Duluth.......	8 35 E	—1
Miss...	Jackson.......	6 18 E	+1
	Oxford........	5 48 E	+1

State or Territory.	Station.	Variation January, 1916 ° ′	Annual Change. ′
Mo.....	Jefferson City..	7 45 E	+1
	St. Louis......	5 07 E	0
	Kansas City...	9 24 E	+2
Mon...	Helena........	20 16 E	+3
Neb....	Lincoln.......	10 00 E	+2
	Omaha.......	9 51 E	+2
Nevada.	Carson City...	17 44 E	+3
	Eureka.......	17 44 E	+3
N. H...	Concord......	14 11W	+6
N. J...	Trenton.......	9 04W	+5
N. Mex.	Santa Fé......	13 29 E	+3
N. Y...	Albany.......	12 11W	+6
	New York.....	10 00W	+5
	Ithaca........	8 16W	+5
	Buffalo.......	6 57W	+4
N. C...	Raleigh.......	2 56W	+3
	Wilmington....	2 43W	+3
N. Dak.	Bismarck......	15 11 E	+2
	Pembina......	11 35 E	+1
Ohio...	Columbus.....	1 28W	+3
	Cleveland.....	3 58W	+3
	Cincinnati.....	0 43 E	—2
Okla...	Atoka........	8 48 E	+2
	Guthrie.......	10 02 E	+3
Oregon.	Portland......	23 30 E	+3
Pa.....	Harrisburg....	7 28W	+5
	Philadelphia...	8 37W	+5
	Allegheny.....	4 41W	+4
R. I....	Providence....	13 15W	+6
S. C...	Columbia.....	0 23W	+2
	Charleston.....	1 13W	+2
S. Dak.	Pierre........	13 07 E	+2
	Yankton......	11 36 E	+2
Tenn...	Nashville......	3 55 E	0
	Knoxville.....	0 26W	+1
	Memphis......	5 35 E	+1
Tex....	Austin........	8 55 E	+3
	San Antonio...	9 31 E	+3
	Houston......	8 24 E	+3
	Galveston.....	8 08 E	+3
	El Paso.......	12 48 E	+4
Utah...	Salt Lake.....	17 21 E	+3
	Ogden.......	18 17 E	+3
Vt.....	Montpelier....	15 18W	+6
	Burlington....	13 48W	+6
Va.....	Richmond.....	4 37W	+4
	Norfolk.......	5 22W	+4
	Lynchburg....	3 27W	+3
Wash..	Olympia......	23 30 E	+3
	Walla Walla...	22 03 E	+3
W. Va..	Charleston....	2 53W	+3
	Wheeling.....	1 56W	+3
Wis....	Madison......	4 45 E	—1
	Milwaukee....	3 04 E	—1
	La Crosse.....	5 25 E	0
Wyo...	Cheyenne.....	15 20 E	+2

A plus (+) sign to the annual change denotes that the declination is increasing, and a minus (—) sign the reverse.

MERIDIAN BY WATCH.—One's watch, if it be keeping correct time, and the sun is shining, can be used as a compass (Fig. 11). The watch being set by local (sun) time, turn the face of the watch to the sun in such position that the hour-hand shall point to the sun. Half-way between the hour-hand and 12 o'clock will then be the *south* point (south of the equator, the north point). Of course, when the sun is near the zenith this trick will not work.

To do the thing accurately, hold a grass stem

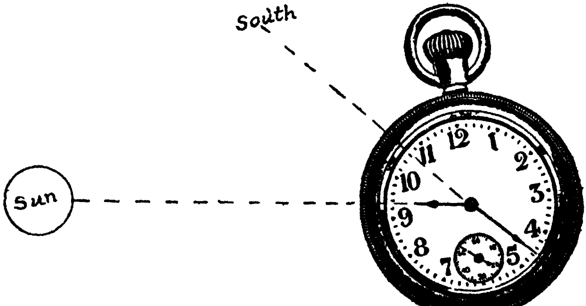


Fig. 11.— Meridian by Sun

or other small object vertically so its shadow will be cast across the face of the watch, and then bring the hour-hand into this shadow.

By laying the watch on a level place and sighting across it at a pole, the true meridian may be established closely enough for most purposes.

MERIDIAN BY SHADOW.—When rough-and-ready methods are not precise enough for one's purpose, the following method will give a true meridian by which variation of the compass may be corrected (Fig. 12): On a smooth and level piece of ground lean a pole toward the north and rest it in a crotch or on shears as shown. Make a plummet with string and stone or other weight, and suspend it from the end of the pole so that the plumb-bob nearly touches the ground.

Drive a peg (*S* in the figure) directly under the plummet. Then, an hour or two before noon, attach a string to the peg and, with a sharpened stick tied to the other end of the string, describe a semicircle, or arc of a circle, with a radius equal to the distance from the peg *S* to the shadow of the tip of the pole. Drive a peg on the arc where the shadow of the tip of the pole rested. About an hour after noon, watch the shadow of the tip as it approaches the eastern side of the arc, and drive another peg at the point

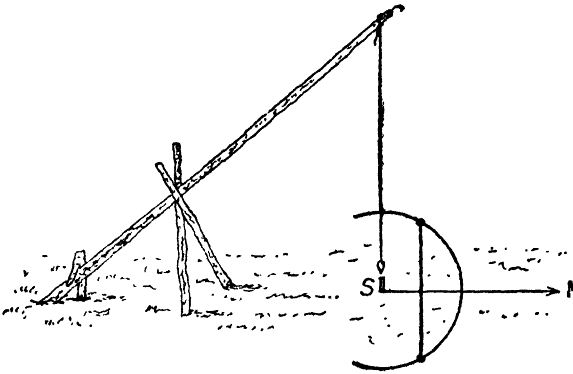


Fig. 12—True North and South

where it crosses. Then with a string find the middle point of the straight line joining the last two pegs mentioned. A straight line joining this middle point and the peg under the plummet will lie in the true meridian.

To get the variation of the compass needle, set up a pole exactly in line with the short line mentioned above, and sight back from the pole to the tip of the slanting stick that holds the plummet. Make a note of the variation, so many degrees east or west, and use this when running a line by compass.

MERIDIAN BY POLE STAR.—Everybody knows the "Dipper" in the constellation of the Great Bear (Fig. 13). Its stars never set but revolve around

the North Star. The two stars forming the front of the Dipper's bowl (*a* and *b* in the figure), called the "pointers," point toward a conspicuously bright

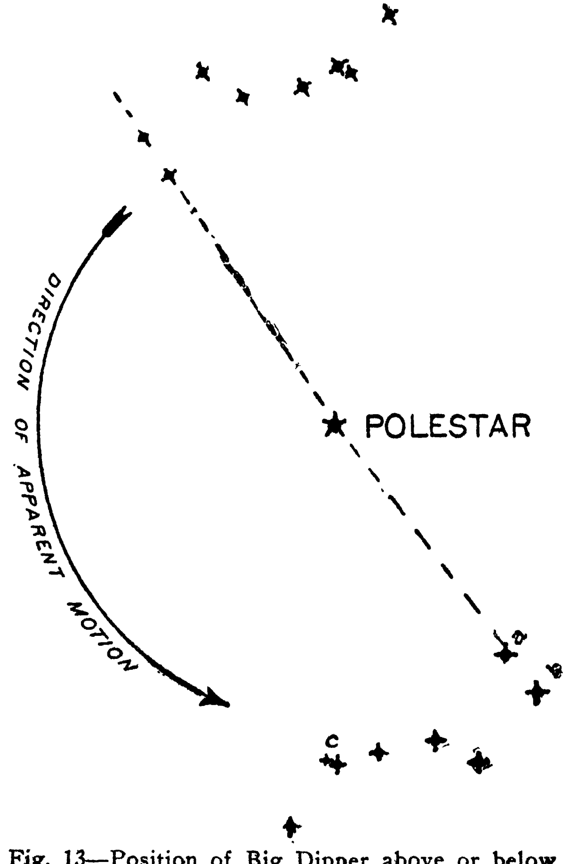


Fig. 13—Position of Big Dipper above or below the Pole Star when the Pole Star is due North.

star which is Polaris, the North or Pole Star.

The North Star bears exactly due north only twice a day. It is always close enough to steer by, but if one wishes to correct his compass by it he must

do so at a time when the double star in the middle of the Dipper's handle (*c* in the figure) is either directly above or directly below the North Star, for that is when the bearing is correct. At all other hours Polaris bears somewhat east or west of true north.

To find the true meridian: set up two poles ten or twelve feet apart and exactly in line with the North Star, at such time as mentioned above. The front pole should be illuminated by a lantern or candle so that correct sight can be taken. Next day the line of sight can be prolonged, and the compass variation determined.

CHAPTER VI

ROUTE SKETCHING—MAPPING—MEASURING

Among the pleasures of life in a wild country I count first the thrill of exploring new ground. "Something hidden: go and find it!" He who does not respond to that mainspring is out of order—his works need looking into.

Of course, the whole earth has been rambled over by somebody before our time; but it suffices one of us to bore into some wild region that is unknown to himself, unknown to his companions, and which never has been mapped in detail.

I used to go hunting, every fall, with two or three comrades who felt as I did about such matters. We never hired a guide. On arriving at a blank spot we would spend the first day or two scouting. We would scatter, scour the country, and then, around the camp fire at night, we would describe, in turn, what we had found.

Verbal reports, such as these, are more entertaining than useful. The crudest sort of a sketch on paper would have taught us much more. By combining our route sketches we might have produced a serviceable map of the country for miles around. I wish we had made such maps. I would love to pore over them in these later years.

We thought that route sketching would take too much time and trouble. That was a mistake. Anybody who can read a compass and draw lines of direction can make a practical route sketch without losing more than twenty-five per cent of a steady

jog. The only instruments and materials needed are a pocket compass, a watch, a lead pencil, and a notebook, or a bit of paper tacked on a piece of thin board.

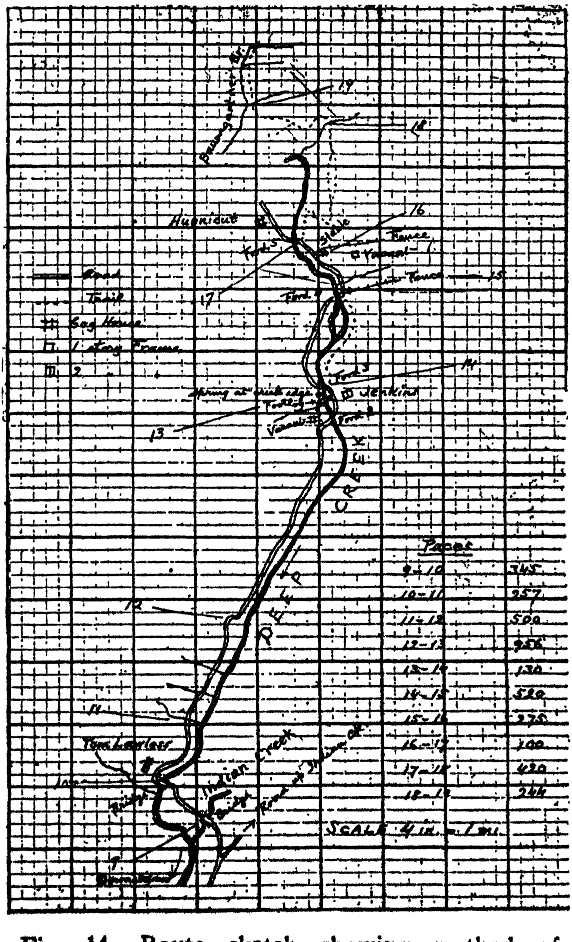


Fig. 14.—Route sketch showing method of computing distances by counting paces from point to point

As examples, I give here a couple of sketches (Figs. 14 and 15) showing, respectively, the backwoods half of the wagon road and the over-mountain trail to "the last house up Deep Creek," where I once lived for a year or so. I made these while still new to the country, without losing more than half an hour from regular marching time. First, I walked in to the railway station, pacing and sketching the trail as I went. The next day I returned by wagon, mapping the road and the creek, without once checking the horses, and judging distances altogether by eye.

My rough sketches were made in a vest-pocket memorandum book that was quadrille ruled. Mere lines showed the road, trail, creek, and branches, as in Fig. 14, and the sketch map was finished on larger paper when I got home. My compass had a dial of only 1⅛ inch, which is small for such work. I wore it in a leather strap on my left wrist, like a wrist watch; so it never was in the way, yet always was right under the eye when needed. To orient the instrument, it could be slipped out of its guard in a second or two, though this was seldom necessary.

Afterwards I discarded this way of carrying a compass, because it had to be open-faced and was too easily smashed.

Considering that the country here was rough, and so densely timbered that there were few outlooks, and that I did not use a protractor nor even a ruler, I was pleased to find that my "closures" required very little "humoring in," as a surveyor would say. I had a U. S. topographical map of the country, but it was so defective that it was of no use, save in establishing one or two "controls."

In sketching a route it is convenient, though not necessary, to use paper ruled in little squares. Any dealer in draughting materials can supply cross-section paper ruled ten lines to the inch. A piece of such paper, about 7 x 10 inches, tacked on a thin board and carried in the hand, is a good way. If

this is too cumbersome, use a notebook, as I did, and, when you come to an edge of the paper, start anew on a fresh page. If you have nothing but plain

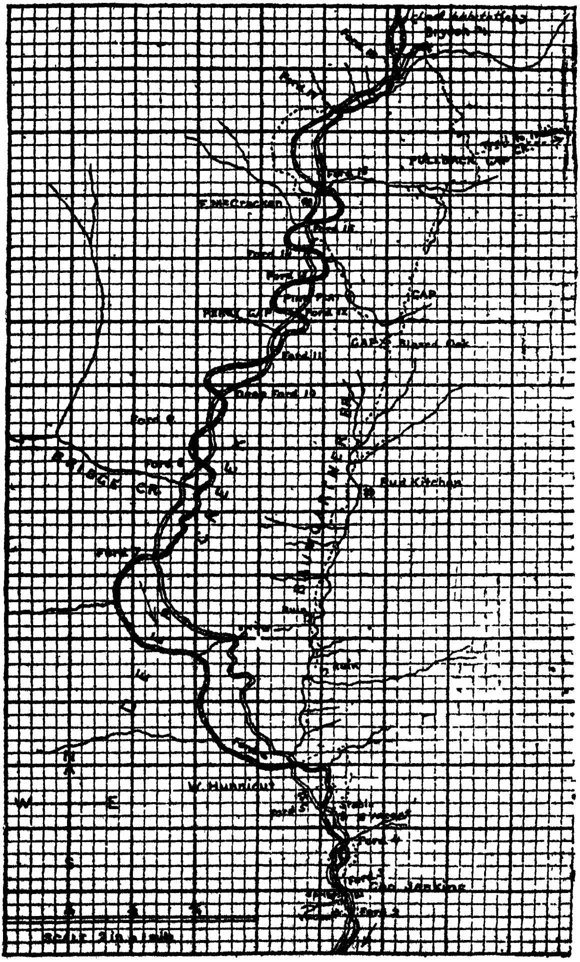


Fig. 15.—Map made by combining two route sketches

paper, a measuring instrument must be used, which need be no more than your octagonal lead pencil on which you have scored two or three inches with their subdivisions.

If you are merely plotting a course, it is not necessary to sketch in so many topographic features as are shown in these examples. In any case it is a mistake to crowd the sheet with details, as they might be confusing. In the present instance the route ran through a mountainous country, but I made no attempt to show contours, nor even to note the steep slopes, for there was a trail all the way. I did note, separately, the marching time from point to point (not shown in sketches), and that is important. The time table of actual marching, in connection with the plotted route, showed plainly enough where the going was slow.

Scale of Sketch.—The first thing to do is to fix on a certain scale to be used in plotting. In Fig. 14 it is four inches to a mile, meaning that four inches on the map corresponds to a mile on the ground itself. Therefore a side of each of the little 1-10 inch squares represents 44 yards of actual distance. In Fig. 15 it is two inches to the mile. (The cuts in this book are reduced from the originals). Sometimes it may be more convenient to use a man's pace or a horse's stride as the unit of a scale. In any case, the scale adopted must be noted on the margin of the paper, and an arrow must be drawn on the map to show the true north and south line.

Pacing Distances.—When traveling afoot, distances are judged by counting one's paces. A man's normal stride varies from 27 to 33 inches, according to individuals and nature of ground. Woodsmen commonly exceed this, owing to their rolling gait. The conventional surveyor's pace is 30 inches, and so is that of infantry "quick time." Do not try to pace yards, or any other arbitrary distance. That is unnatural, fatiguing, distracts your attention, and cannot be kept up on a long hike. Walk at your

natural stride back and forth over a measured distance, and average the results. Do this after a long walk, for by that time you will have "struck your gait." Practice first over fairly level ground, and then up and down steep places, learning to make allowances, by lengthening out a little when going up-hill and shortening the stride when going downhill.

One's stride on the march, after he has settled down to it, is likely to be longer than it is in town. In my own case, on a hike over fair road, I find that my pace is about 33 inches (three inches longer than it is around home), and the cadence of a steady jog is 100 steps to the minute. This makes 1,920 paces to the mile. Allowing for uneven ground, I figure on 2,000 paces to the mile, and three miles an hour. This happens to be convenient in plotting, for, when mapping on a scale of, say, four inches to the mile, each of the 1-10 inch squares on my cross-section paper represents just 100 paces of 31.68 inches average, and on a scale of two inches to the mile it is 50 paces. Timber cruisers figure on 2,000 paces to the mile, or 1,000 "cruiser paces" (double paces, as explained below).

THE APPLICATION.—At the start, take the bearings by compass of some object that you can see in advance. Then jog along, counting *every other pace* (left or right foot only) as you go. To count every single pace would be needlessly wearisome. Where there is a long distance between bearing points, drop a pebble into your pocket for every hundred double paces.

When the object you sighted is reached, mark its location on the paper, as nearly as you can, according to compass bearing and distance traversed. Until you become skilful at this without sight compass and protractor, check your first reading by turning around and taking the bearing back to your starting point.

Having located the object, draw a line from the

starting point corresponding to your course, number this first stop "1," and note on the margin the number of paces from 0 to 1, as well as the time between them. Then take a fresh bearing on some other object ahead, and continue the same way.

TIME.—In the wilderness, where roads generally are bad, if there are any at all, the distance traversed is of less consequence, for a mere route sketch, than the time taken to cover it. Your estimates of distance may be faulty, but your watch can be relied upon.

Time measurements also are good enough for rough mapping of open country and fairly straight courses, where it is not necessary to count paces in order to keep the general bearings correct.

JUDGING DISTANCES BY EYE.—In thickets, swamps, blow-downs, steeps, and other places so rough that one can neither pace steadily nor judge distance by time, a man going alone must estimate by eye only. It is remarkable how skilful men can become at this by assiduous practice. Riflemen generally are good judges of distances by eye. Timber cruisers are better still. Amateurs should seldom trust their estimates of distance in the woods and mountains, or over water, for intervals of over 100 yards.

When two men travel together they can assist each other in estimating. Let your partner walk away 100 paces, then hold your pencil at arm's length, and measure his apparent height on it from pencil tip down with your thumb-nail, as an artist does in landscape sketching. Mark that point with your knife. Then let him go another 100 paces; measure and mark again. This scale can be used thereafter wherever his full height is visible.

PEDOMETERS save considerable trouble where trails are good or the country is fairly level and open, but they are of no use in rough country, since they record every step taken, regardless of whether it is in the course or not.

Paces of Animals.—The paces of saddle animals vary according to individuals, but can soon be determined by test. This should be done both at walk and trot, counting only the double pace, like that of a man, when walking, or the rise when trotting. The pace of a horse is as uniform as that of a man. A mule's gait is still steadier and the stride is more even.

Distance by Sound.—In mapping a considerable territory in the mountains, where pacing is unreliable and may be impracticable, two men can work to advantage if one carries a gun or pistol and the other a stop-watch. For example, you wish to know the distance from camp to a certain peak. The man with the gun climbs the peak, and fires a shot when he gets there, to call his comrade's attention. Then he ties his neckerchief on a stick, and, stepping out in plain view, signals with the extemporized flag, and fires at the same instant. The man in camp times, with his stop-watch, the interval between signal and arrival of the gun's report. Sound travels, in quiet open air, approximately at the following rates, according to temperature:

VELOCITY OF SOUND

At—	30°	Fahr.,	1030	ft. per sec.	=1	mile in	5.13	secs.
"—	20°	"	1040	"	=1	"	5.08	"
"—	10°	"	1050	"	=1	"	5.03	"
"—	0°	"	1060	"	=1	"	4.98	"
"—	10°	"	1070	"	=1	"	4.93	"
"—	20°	"	1080	"	=1	"	4.88	"
"—	32°	"	1092	"	=1	"	4.83	"
"—	40°	"	1100	"	=1	"	4.80	"
"—	50°	"	1110	"	=1	"	4.78	"
"—	60°	"	1120	"	=1	"	4.73	"
"—	70°	"	1130	"	=1	"	4.68	"
"—	80°	"	1140	"	=1	"	4.63	"
"—	90°	"	1150	"	=1	"	4.59	"
"—	100°	"	1160	"	=1	"	4.55	"
"—	110°	"	1170	"	=1	"	4.51	"
"—	120°	"	1180	"	=1	"	4.47	"

When the air is calm, fog or rain does not appreciably affect the result; wind does, of course. The

report of a gun, being sharp and loud, travels considerably faster than this for a *short* distance, but the above table is a close enough approximation for the purposes of sketch mapping.

DISTANCES ON RIVERS.—Floating down a river of fairly regular current, one may estimate distances pretty closely by keeping his boat in midstream and timing it from point to point.

LANDMARKS.—My sketches show how landmarks are noted along the route. In the wild and uninhabited country beyond our house I would have noted old camp grounds, gaps, bad thickets, cliffs, etc., in a similar way. Where the forest and contours are of uniform character, one should establish here and there, some artificial marks. Where tree blazing is not permitted, blazed stakes may be driven, bush-marks made, stones piled, and so on, according to circumstances.

Written notes will help anyone who is to follow the route. The examples here printed were made for a friend who wanted to visit me, but who could not foretell, a day in advance, when he could get away from business. After directing him to get a U. S. Geological Survey topographical sheet for the country south of us, which was accurate up to the place where my sketch map began, I wrote him:

There are two ways to our place. One is a wagon road over which a team can haul one thousand pounds when Jupiter isn't pluviating. There are eighteen fords in the last six miles. The creek is impassable for a few hours after a smart rain. Ford 10 ("the deep ford") always wets a wagon bed. Ford 12, at the Perry gap, is dangerous when there is ice. No footbridge between Hunnicut's and McCracken's, nor any habitation.

The other way is by trail across the mountain from Hunnicut's. This is always practicable for a mountain-bred horse or mule with light pack, but he must do some sliding down from either the McCracken gap or the Pullback.

Trail at Hunnicut's stable swerves sharply to the right, up a steep bank, and thence onward goes through thick forest. At McCracken gap our fork

of the trail is marked by a small oak, with burl at height of your head, blazed last year with a cross, and pencil-marked with arrow. The trail to Indian Creek and the Cherokee reserve on Lufty is much fainter than ours.

MAPPING.—Observe that a mere route sketch is only intended to show the way from one point to another, and tell the user where he is at any stage of the journey. Hence it need not be mathematically accurate, and hence it can be made swiftly, with crude instruments. Mapping proper is much slower work. Still, a very useful and practical map of a region several miles square can be made in a few days by one man, combining his route sketches, provided he takes a little more pains in locating a few prominent landmarks as "controls."

In the example already given the country was so heavily timbered that there were few outlooks from which mountain tops or other features could be observed from different points on the journey. If there had been such, I would have noted their bearings from different positions, and thus would have had a series of positive checks or controls by which to regulate my sketches. How this is done is shown in Fig. 16, which is reproduced from an article in *Outing,* by C. H. Morrill. In this case a 4 x 7 notebook was used, the left-hand page being ruled for notes on compass bearings, distances (a pedometer was carried), time, etc., while the sketch was drawn on the right-hand page. Notice the compass bearings of mountains, brooks and pond.

If a similar trip had been made a few miles away, and bearings taken on objects visible on the first route, the two sketches could be combined into a map, as in Fig. 15. Where there were discrepancies they could be humored in by "splitting the difference," and the finished work would be true enough for practical purposes.

If one has a reliable map of the region he is in, but on too small a scale to show the details that he

wants to record, he can use some of the major features on the map as controls, and thus make his sketch map pretty accurate.

A method of making more accurate sketch maps with an improvised plane table, or with a cavalry sketching case carried on the left wrist, is given in a handy little pocket manual of *Military Map Reading; Field, Outpost and Road Sketching*, by Major Wm. D. Beach, U. S. A. (Hudson Publishing Co., Kansas City, Mo.).

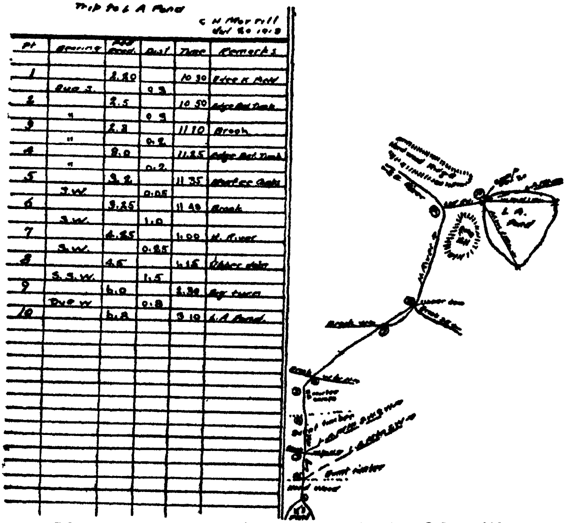


Fig. 16.—Route sketch by C. H. Morrill

EXTEMPORARY MEASUREMENTS.—A 3-foot pocket steel tape weighs only a couple of ounces and takes up no more room than a watch. It is a good thing for a woodsman to carry, as he often has occasion to take measurements. Where the tape is inconvenient to use, he can measure with it a certain length on a straight pole, or on a fish line. Lacking this, he should have a measure scored on his pencil, hatchet handle (if straight), inside of waist

belt, or some other article of equipment that he constantly carries.

He should also know some of the measurements of his body. The first joint of the little finger, for instance, may be one inch, or the thumb an inch wide. Clench both fists, making the extended thumbs meet: this may be just one foot. Measure the span of thumb and little finger and the height of your eye from the ground. The full stretch of the extended arms is often used, but is unreliable on curved surfaces, as in measuring the girth of a tree, since it will be several inches shorter than if one stood with his back to a flat wall and stretched his arms horizontally.

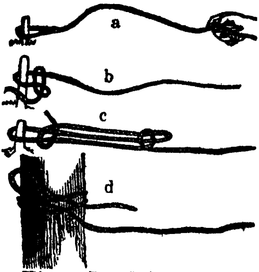


Fig. 17.—Hitches on Measuring Line

To measure successive lengths with a stout cord, such as a fishing line: Knot the line two or three feet from one end, measure off, say, 100 feet from this, and knot again, leaving a stray end beyond the second knot. One end could be looped, as in Fig. 17*a,* in which case you stick a smooth peg in the ground, put the loop over the peg, carry out the hundred feet, set a peg there, and then jerk the line upward, which, if the ground is smooth, will cause a wave to run along it that will lift the loop off the first peg. But a permanent loop is too likely to catch in bushes, etc.: so it is better to leave plain ends as I have described, and make your loop each time with a hitch (Fig. 17*b*) so it may shake out as it comes off the peg, leaving only a free end to be hauled in. A sheepshank (Fig. 17*c*) may be used for the same purpose.

However, in the woods, it is better to fasten your line with a signal halyard hitch (Fig. 17*d*) to any convenient small tree or bush that stands fairly in

the line you wish to measure. Pass the end of the line twice round the stem or peg, then, taking the end and a small bight of the measuring part, hitch them as if you were going to tie a reef knot, pull the first hitch tight, but do not complete the knot by making the second hitch; this will hold quite fast enough, and a slight jerk will be sufficient to set it free when you wish to haul in the end.

A measuring line should merely be straight upon the ground, not drawn taut; still less should it be lifted up and then pulled to a straight line in the air. Cords of any kind are too easily stretched to be trusted for measuring if there is any strain on them.

To Set Out a Right Angle.—Any triangle the sides of which are in the proportion of 3, 4, and 5, is a right angled triangle. For example: Measure 40 feet on a line that you wish to run at right angles, Peg *A* and *B* (Fig. 18). Fasten end of tape at *A*, take 80 feet, and fasten 80-foot mark at *B*. Then, taking tape in hand, walk aside till *BC* and *AC* are taut. *BC* is then perpendicular to *AB*, and *B* is a right angle.

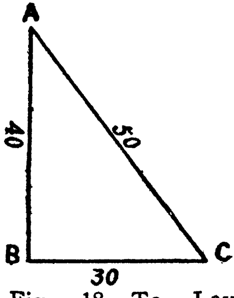


Fig. 18.—To Lay Out a Right Angle

To Measure an Inaccessible Distance.—The width of a river, for instance, may be measured with the aid of a pocket compass. Say the river runs east and west, and you are on the south side. Choose a tree (*A*, Fig. 19), or other well defined mark on the opposite shore, and bring it to bear due north of you. Mark your position with a peg at *B*; turn to one side, say the left, and walk westward till *A* bears exactly northeast, and put a peg there, *C*; then *CB* will equal *BA*, the breadth of the river, because *CB* and *BA* subtend an angle of 90°, or a

right angle, and must therefore be of equal length.

Since your readings on a small compass may not be quite true, check them, if the ground permits, by walking east till *A* bears northwest from *D*. If the

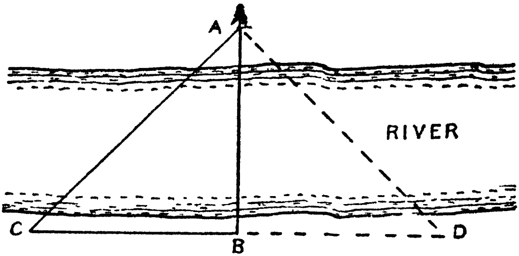


Fig. 19.—Measuring Width of River by Compass.

two observations do not quite coincide, the mean of the two will be approximately correct.

If you have no compass, there are many ways of measuring an inaccessible distance by angles otherwise determined, provided there is enough level land on your side for the purpose. One of these is shown in Fig. 20. Sight a conspicuous object, as before. Plant a stake about 5 feet high at *A*, as nearly opposite and "square" as you can judge. Set up another stake at *B*, as nearly at a right angle as you can, and at about one-half the estimated distance to your mark. Continue *AB* straight to *C* and plant another stake. *AB* must equal *BC*. Now set a stake at *D*, at right angle to base, wherever the line *DB* continued will strike the object across the river that you have been sighting at. Then *DC* equals the width across.

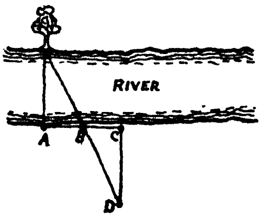


Fig. 20.—Measuring Width without Compass

To Measure an Inaccessible Height or Depth.—Suppose you wish to measure the height

of a cliff, a tree, or other object the base of which you can reach, and with fairly level ground in front of it. In Fig. 21, the man wants to know the length of the merchantable "stick" below the tree branches. He estimates the height by eye, then paces off that distance and maıks it at *C.* He cuts a stake about as long as himself, stands it in front of him and marks on it with his knife the height of his eye, then sharpens the few inches remaining. At *C* he drives

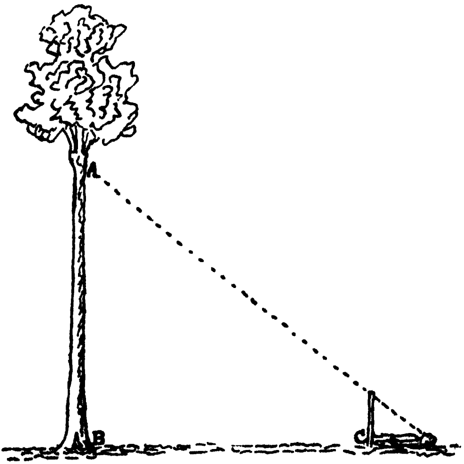


Fig. 21.—Measuring a Height.

the stake perpendicular, with the knife mark level with the ground. Then he lies down with feet against the stake, as shown, and sights at the tree. If the line of sight over the top of stake does not strike the point *A,* he shifts, and tries again, until the alignment is correct. The height *AB* then equals the distance *BC.*

Some backwoodsmen have a rough-and-ready way of estimating the height of a tree. They walk off until its topmost branches or first fork can be viewed by looking backwards between the outstretched legs;

with practice this method may become pretty accurate.

On level open country a height can be measured by shadow. Set up vertically a stick of known length; measure the length of its shadow, and that of the object whose height is required. As the length of stick's shadow is to stick's length, so is that of the object's shadow to the object's height. For example: the stick is 5 feet long and its shadow 7, while the shadow of the tree is 70 feet; then 7:5::70:x, and x=50 feet.

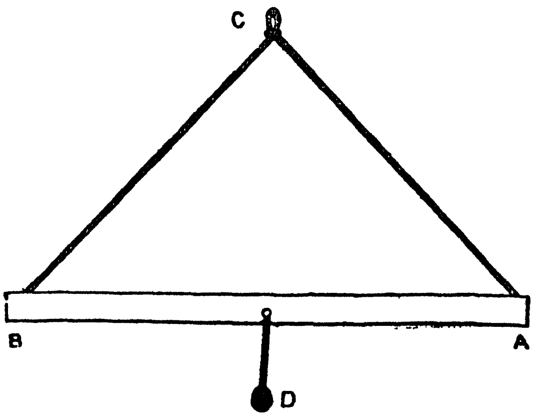


Fig. 22.—Extemporized Level

To measure a depth with the watch: square the number of seconds a stone takes to reach the bottom, and multiply by 16: the result is the depth in feet.

LEVELING.—Take a short straight stick or ruler, *AB* in Fig. 22, mark it exactly in the middle, and suspend it with a string with loop at *C* directly over the middle of the stick, from which latter a little weight *D* is suspended to keep the wind from shaking the level. To use the instrument: hold it from *C* above your head so that top of stick is in line with your eye, and sight along the surface, noting at what point of the ground the line of sight corresponds.

Going there, you have ascended a distance equal to the height of your eye from the ground. Many applications of this method will suggest themselves.

I do not give more elaborate processes of measuring and leveling, because the simple ones here described are accurate enough for a woodsman's purposes, and they take little time or trouble.

TIME.—A leaf of an almanac for the month you are out is useful in case your watch runs down. The *World Almanac* shows the time of rising and setting of sun and moon for four different zones from the Atlantic to the Pacific. These, of course, are dependable only when you can observe them on a level horizon; but the time when the sun is in the zenith (directly overhead) is also given for every day in the year, on the meridian of Washington, and you can allow for the difference in time wherever you may be. The sun is in the zenith when a straight pole casts its shortest shadow.

A practical sundial is easily extemporized by sweeping off a level place and planting in it a 5-foot stick slanted toward the north by compass. Nail the stick to a stout stake driven under it, so it cannot be moved, and sharpen the upper end so as to cast a finely tapered shadow. When the sun shines, take your watch and stick a peg at the end of the shadow for each even hour. Subdivisions of the hour can be marked by shorter pegs. In a fixed camp such a sundial is handy near the cook's fire. Often I have boiled my three-minute eggs by one. If the pegs are altered every week they will indicate near enough actual sun time for practical purposes.

CHAPTER VII

TRIPS AFOOT

Quand na pas choual, monté bourique;
Quand na pas bourique, monté cabri;
Quand na pas cabri, monté jambe.
(When you have no horse, you ride a donkey;
When you have no donkey, you ride a goat;
When you have no goat, you ride your legs.)
—*Creole Saying.*

The man who goes afoot, prepared to camp anywhere and in any weather, is the most independent fellow on earth. He can follow his bent, obey the whim of the hour, do what he pleases whenever he pleases, without deference to anybody, or care for any beast of burden, or obedience to the course of any current. He is footloose and free. Where neither horse nor boat can go, he can go, seeing country that no other kind of traveler ever sees. And it is just these otherwise inaccessible places that have the strongest lure for anyone who delights in new discovery, in unspoiled nature, and in the charms of primitive society.

The man with the knapsack is never lost. No matter whither he may stray, his food and shelter are right with him, and home is wherever he may choose to stop. There is no anxiety about the morrow, or the day after. Somewhere he will come out—and one place is as good as another. No panic-stricken horse, or wrecked canoe, can leave him naked in the wilderness.

But how to do it? This is the hardest problem in outfitting. To equip a pedestrian with shelter, bedding, utensils, food, and other necessities, in a pack so light and small that he can carry it without overstrain, is really a fine art. One can't enjoy wild

scenery and backwoods characters if bending and chafing under a load of fardels, all the time conscious that he is making a pack animal, a donkey, of himself.

Consider, then, your personal equation. If you are a middle-aged city man, soft from a year or more of office work, about twenty pounds on your back is all the weight that you ought to carry. Even that little will be burdensome the first day out; but soon you will be striding along all day hardly knowing it is there. A younger man, or one who gets a good deal of daily exercise in the open air, can do the same with thirty pounds, until he gets in training, and then go considerably more.

I am speaking of all-day hikes, across country, through the woods, uphill and down dale. In untracked wilderness, especially if it be mountainous, it takes a husky fellow, in good form, to pack fifty pounds without over-exertion. Yes, infantrymen carry seventy, sometimes, but they don't do it through thickets, over rocks and down-logs, up and down ravines, where there are no trails—nor are they out for the fun of the thing. The personal equation, then—your own—regardless of what other folks do, or think you ought to do. Find out what is light and easy for you, and then *GO LIGHT.*

Weigh the essentials. Are you to sleep out? You need a comfortable bed, shelter from rain, and security against venomous insects. Food, then, for how many meals? Choose what can be cooked with the simplest and lightest utensils, and what will give you the most nourishment for its weight and bulk, and such as does not require more than half an hour to make ready and fit for the stomach. Bedding, shelter, food and something to prepare it in: those are the essentials, besides the clothes on your back and the contents of your pockets. Anything else is dispensable, to be picked with care and weighed with scales, and balanced against some other thing that might be of more real use or pleasure.

Then how is the weight to be carried? A great

deal depends on getting a pack so adjusted that it will "ride" just right, shoulders and hips each bearing their due part of the strain, with as little binding and chafing as possible.

Finally, will you go in company or alone? A party of three or four uses the same tent, utensils, and some other articles in common. That means less weight for each man to carry. Two in a bed require less bedding than if they slept separately. A satisfactory kit for one man who goes alone and afoot is the last refinement in camp equipment. Because this is a particularly difficult problem I shall give it special attention. Whoever masters it will have little trouble in getting up a squad outfit.

CLOTHES.—This topic has been considered in detail in Vol. I. (pp. 138-163). Little need be added. Footwear is the most important item. Shoes and socks must *FIT*, or you will be made miserable by blisters. For dry weather and fair roads, the standard U. S. Army shoes are excellent; but for rough country, heavier ones, made over the Munson last, are required. In the wilderness there is considerable wading to do, sometimes over the shoe tops. The only shoes that will stand it are those that are waterproofed and have no lining whatever: they dry out soon on the march, and do not get hard or "bowed up." Buy them of some firm that makes a specialty of sportsmen's footwear.

Up to the season when Mackinaws are needed, do not carry a coat. You would not wear it on the march, and, when the cool of evening comes, a sweater coat or a Mackinaw stag shirt is more comfortable, besides being a good night garment, which the coat distinctly is *not*. Then have a light-weight rubber cape reaching just to the knee. From the knee down you will get wet anyway, even though you wear a long poncho or rain coat, and any garment that flops against the legs at every stride is a positive nuisance; besides, it will soon tear when you thrash through brush, and it will trip you at every step in climbing. A cape has the merits of a pon-

cho, in that it is airy underneath, and it can be slipped on over the pack-sack, while it has the advantage of leaving your arms free to fend off bushes, to climb with, to shoot, paddle, and so on.

There is a pattern called the "Fairy," 34 inches long, that weighs only 21 ounces and takes up hardly any room when packed. It and a medium-weight sweater coat together weigh only about six ounces more than a duxbak hunting coat. Worn together, they form good protection against a cold, keen wind.

Carry a change of underwear. When on a hike, take your bath or rub-down at close of day, instead of in the morning; then change to fresh underwear and socks, and put on your sweater and trousers to sleep in. Fresh dry underclothes are as warm as an extra blanket would be if one slept in the sweaty garments he wore during the day—to say nothing of cleanliness.

Shelter.—Rain is the campaigner's worst enemy. Jack Frost can be kept at bay, in a timbered region, though you be bivouacing under the stars; but you require a waterproof roof to defy Jupiter Pluvius. The kind will depend chiefly on whether you go alone or in company. For two or more, choose one of the very light tents described in Vol. I. (pp. 76-108). When going alone, in summer, a simple shelter cloth and small mosquito bar are sufficient. They can easily be made at home. Take, for example, seven yards of the green waterproof material called verdalite, which comes in 38-inch width, and weighs 4¼ ounces to the running yard. Sew up three widths of seven feet length, and hem all around, making a rectangle very nearly 7 x 9 feet. Put small grommets or eyelets around all four edges, for tie-strings. The completed shelter cloth, in this material, will weigh about 2¼ pounds, in waterproofed "balloon silk," or similar stuff, about 2½ pounds.

Such a cloth may be set up in various ways. One of the quickest is to tie or nail a pole horizontally from one sapling to another, four feet from the

ground, for a ridge, and tie one of the 9-foot sides of the cloth to it. Tie the other side of the cloth to another straight pole, draw out to an angle of 45°, and pin the pole down with an inverted crotch at each end. That is all. You have a shed roof sheltering a space 5¾ by 9 feet, and 4 feet high in front. Under this you sleep parallel with the fire, instead of feet toward it. If no small trees stand in the right place, set up a pair of forked stakes, or, on rocky ground, shears (Vol. I., p. 46). Sharpen both ends of a pliant green stick, bend it into a bow, and drive the ends into the ground on either side at the head of your bed, to support your mosquito netting; crawl under, and tuck the edges of the net under your bedding.

Smoke from the camp-fire does not hang under such a shelter, as there is free draught through it. If the wind shifts lean a pole against the ridge, on the windward side, and stack some boughs against it. Nothing could be simpler, cheaper, lighter, more compact, nor, in the long run, more satisfactory for the lone forest cruiser in summer, than this plain rectangle of thin but close-woven waterproof cloth. One of its advantages is that a stretcher-bed, if you carry such a thing, can be set up under it without bother about the length of poles. With the cloth set up over a big fallen log for windbreak, as already described under BIVOUACS, there is plenty of headroom. If you wish to stay a few days in one place, the cloth can be used as a roof over a frame of baker tent form. I carry a few wire nails and tacks for making such a structure.

For a mosquito bar, take two yards of the fine mesh that comes in 68-inch width, and hem the ends, or use bobbinet, which is stronger and a better protection.

BEDDING.—Don't bed down on the cold, hard earth. And, unless you know the country to be traversed, don't depend on finding balsam or hemlock for a browse bed wherever you may spend a night. In Vol. I. (p. 134) I have spoken of the

bed tick. One that I now have, made of romper cloth, is a bag 32 x 78 inches, to be filled with dry leaves, if nothing better is found, and closed with horse-blanket pins; it weighs just one pound, and takes up very little space in the knapsack. The leaves, being in a bag, cannot spread from under you; they cushion the body and keep off the chill of the ground. A 3-pound blanket on top of such a mattress is warmer than a 5-pound one without it, and a pound weight is saved, to say nothing of bone-ache. That is enough for summer camping, unless you are at a considerable altitude.

A 20 x 30-inch pillow-bag will weigh 3 ounces. Stuff it with leaves or other soft material, before you turn in at night, close the end with safety pins, and pin your towel over it if the surface is not soft enough.

Cooking Kit.—It is easy to make up a good light-weight set of utensils for two or more men (see Vol. I. pp. 118-123), but a satisfactory one-man kit is another matter. The Boy Scout sets do fairly well for a short outing when baked bread is carried, but are inadequate for baking on the journey. A reflector is too cumbersome for a lone woods-cruiser. Let him bake his bread and cakes in a frying-pan (see Vol. I, pp. 344-345). This calls for an 8 or 9-inch pan. Get one with folding handle (detachable ones are easily lost), or take a common one, cut off all of the handle but about 1½ inches, and rivet on this stub a semi-circular socket into which you fit your stick for a handle when you go to cooking. For general use I do not like aluminum frying pans, but when traveling afoot they are satisfactory. A deep aluminum plate fits inside the pan in my kit, along with an aluminum fork, white-metal dessert spoon, and a dish towel. When tied up tightly in a light bag they do not rattle around. You want two little kettles for cereals, dried fruit, tea or coffee, to mix dough in, and the like. A pot that is broad and shallow boils water much sooner than one that is deep and narrow, and it is easier

to clean. The kettles must not be too big to stow in the knapsack. Anyway, when one is going afoot he does not want to bother with food that takes long boiling, and so has no use for a large kettle, I choose two 1-quart aluminum buckets, which can be bought through any dealer in kitchen ware, fill them with part of my foodstuffs, set them bottom to bottom, and tie them tightly in a bag so that the covers will not come off. So there is no waste space, for the food must go somewhere, anyway. The kettles are good protection for perishables. Thus no sooty vessel goes inside another, and you have a package of small diameter.

A seamless tin cup is carried wherever convenient, generally outside the pack, where it can be got at when one is thirsty. Aluminum is much too hot for cup and spoon. The complete kit weighs just 2 lbs. 2 oz. including bags. No table knife is carried, as I wear a sheath knife.

TOOLS, ETC.—In summer the little 12-ounce tomahawk already mentioned is all that is needed in that line, its chief uses being to get kindling in wet weather, provide poles and thatch for shelter, blaze a trail, and so on. A small pair of side-cutting pliers is well worth its weight, if you are a fisherman.

The first aid kit mentioned in the following lists is made up as described in Vol. I. (p. 175), with the addition of a "snake doctor" which consists of a hard rubber tube, about half the size of a fountain pen, in one end of which is a lancet (very dull as you buy it) and in the other a receptacle containing potassium permanganate in crystals ready to be rubbed into the incision. There is also a pair of splinter forceps. The whole goes in a tin tobacco box, 4⅜x3¼x1⅛ inches, sealed airtight with adhesive plaster, and weighs 5 ounces.

Other small "icta" will vary according to one's personal taste and requirements. The point is to have them compact and of unnoticeable weight. For a trip afoot there is no need of a whole spool

of thread, for example, or of wire, or a quarter-pound mirror, or a large towel, or a whole cake of soap.

ONE-MAN KIT FOR SUMMER.—As an example, to be modified each for himself, I list below a summer marching and camping outfit (good also as a canoeing kit) complete for a man going alone. It is enough in most parts of our country, but warmer bedding would be required at high altitudes, and perhaps a closed tent, such as the "Compac" or one of the semi-pyramid type, weighing 3½ to 4 pounds, instead of the one-pound shelter cloth. The total weight of the pack, as here given, including two days' full rations, is 23 pounds 2 ounces. The whole equipment, except the few light articles worn on the person, stows *inside* a pack sack of moderate dimensions. There is nothing exposed to advertise your mission; so you give the idle curious something to puzzle and fret over—which is good for them.

With such an outfit and his gun or fishing tackle, camera, or whatever may be the tools of his outdoor hobby, anyone of average physique and a little gumption can fare very well in the open, and enjoy absolute independence.

It will be noticed that little is carried on the person. Such things as are used many times a day are right where they can be reached without fumbling or pulling out the wrong article. Very little weight is carried on the belt. Comfort and suppleness of movement have been studied. There is no "ditty bag"; I discarded such a pouch long ago. If worn on the left side it often is in the way, and it dangles provokingly when you lean over or get down to crawl. If carried on the belt it is too heavy there. When I go out just for a day, I carry on my back a miniature knapsack containing the cape, lunch, tea pail, and such other things as I need for the work at hand. Five or six pounds on the back is less burdensome than half that weight in a ditty bag, and it is out of the way.

It is important in marching that the trousers should be held snug up in the crotch, or there will be chafing. They should not be tight around the abdomen, as that would constrict blood-vessels and interfere with digestion. Stout men, and those with narrow hips, cannot depend on a belt, unless it is drawn very much too tight. Ordinary suspenders are best for them, but many object to their appearance, and so the "invisible" kind is specified in this check-list, although it is hard on buttons.

SUMMER EQUIPMENT FOR BACK-PACKING

WEAR

Woolen gauze undershirt.
Woolen gauze (or balbriggan) drawers.
Woolen socks, winter weight, natural color.
Army overshirt, olive drab chambray (or flannel).
Silk neckerchief, 27 x 27 in.
Khaki trousers, extra suspender buttons.
Invisible suspenders.
Leather belt, narrow.
Army shoes, cone-headed Hungarian nails.
Army leggings, canvas.
Felt hat, medium brim, ventilated, felt sweat-band.

IN POCKETS

Left shirt.—Map sections, in cover. Leaf of almanac. Note book and pencil.
Right shirt.—Compass.
Left trousers.—Purse. Waterproof match box, flat pattern (as reserve).
Right trousers.—Pocket knife.
Fob.—Watch.
Left hip.—Pipe. Tobacco.
Right hip.—Bandanna handkerchief.

ON BELT

Right side, front.—Waterproofed matches (50) in leather belt-pocket.
Right side, rear.—Sheath knife.

ON BACK

	lbs.	oz.
Duluth pack sack, 24 x 26 in. (see Fig. 32) ..	2	4
Shelter cloth, 7 x 9 ft., waterproof	2	4
Mosquito net, 68 x 72 in.		4
U. S. A. blanket, summer weight, 66 x 84 in. ..	3	.
Browse bag, 32 x 78 in.	1	
Pillow bag, 20 x 30 in.		3

Rubber cape, 34 in.	1	5
Stag shirt	1	8
Spare suit underwear and socks, as above	1	2
Tomahawk, muzzled		12
Side-cutting pliers, 5 in.		4
Carborundum whetstone, 4 x 1 x ½ in.		2
Wallet fitted with small scissors, needles, sail needle, awl point, 2 waxed ends, thread on card, sail twine, buttons, safety pins, horse-blanket pins, 2 short rigged fish lines, spare hooks, minnow hooks with half barb filed off, sinkers, snare wire, rubber bands, shoe laces		6
Strong twine in bag		1
Aluminum frying-pan (8⅝ in.), plate, fork, white-metal dessert spoon, dish towel, in bag	1	1
2 Aluminum buckets (1 qt.), in bag		14
Tin cup, seamless (1 pt.)		3
Nails and tacks		3
Cheesecloth, 1 yd.		1
Fly dope, in pocket oiler		2
Talcum powder, in wpf. bag		1
Comb, tooth brush, tiny mirror, bit of soap in wpf. bag, rolled in small towel secured by rubber bands		6
Toilet paper		1
First aid kit		5
Spare matches, in tin box secured by adhesive plaster		2
Electric flasher, flat, round corners		5
Total pack without provisions	18	3

TWO DAYS' RATIONS

		lbs.	oz
Bread, or prepared flour, in wpf. bag	*net*	1	
Cereal, in bag	"		8
Milk powder, in bag (=1 qt. milk)	"		4
Butter, in tin	"		4
Bacon, sliced and trimmed, in waxed paper	"		12
Cheese, in waxed paper	"		4
Egg powder, in bag (=9 eggs)	"		3
Raisins, in bag	"		4
Dried apricots, prunes, or cranberries, in bag	"		4
Sugar, in bag	"		6
Chocolate (for eating), in waxed paper	"		4
Coffee, ground, in bag	"		2
Tea, in bag	"		1

Salt, in bamboo tube .... "		2
	4	10
Bags, paper, tin, tube		5
	4	15
Pack complete..	23	2

The articles in the main pack suffice for an indefinite period. If one is going out only for a couple of days he will not carry all of them. The provisions afford a varied diet, yet weigh no more than "iron rations" of hardtack, bacon, and coffee, and they keep as well. They are very nourishing for their weight, being almost water-free (except fresh bread, if taken instead of flour). Since one usually travels either where fish or game can be secured, or where farm produce can be bought, the food packed along may last longer than two days. If such rations as those here listed were carried sufficient for a week, the whole burden would still be only about 35½ pounds, allowing for a larger pack sack.

When bread is to be baked on the journey, I make up a mixture beforehand of wheat flour (2 parts), cornmeal (1 part), a little egg powder, and some baking powder sifted in. This makes a fine johnny-cake, lighter than common frying-pan bread, wholesomer, and better tasting.

Abjure all canned stuffs on a marching trip. If you test the canned meats, etc., that are put up in tins small enough for one man, you will find that nearly or quite half of the weight is *in the tin.*

The little bags mentioned above are made of the thin but stout paraffined cloth called by tent makers "balloon silk." Salt draws too much moisture to be carried in a bag, and it quickly rusts tin; so cut a joint of bamboo to proper length, put in the salt, and secure the cork with a strip of adhesive plaster. Such tubes are useful for various purposes, being very light and unbreakable.

In Vol. I. (p. 190), I spoke of the difficulty in get-

ting milk powder made of anything richer than skim milk. Since then I have learned that a certain New York outfitter keeps in stock milk powder that contain 27½ per cent. of butter fat, which is the U. S. Government standard for whole milk, cream included, and it is good.

A waterproof match box is good for emergencies, but not for a smoker's daily supply. For this I waterproof the matches themselves, as described in Vol. I. (p. 173) and carry them on my belt in a snap-buttoned pigskin case that came originally with a round carborundum whetstone. This is the handiest way I know of when one does not wear a coat or vest. A similar pocket will carry thirty .22-caliber cartridges for your rifle or pistol.

A bag of the cheesecloth is used to carry fish in, or to hang up game in when flies are about, and a little square of it serves as substitute for a tea-ball.

Nails are not needed unless you expect to stay several days in one place and wish to put up a lean-to of baker tent shape, with shelter cloth for roof, and thatched sides and back—then they are useful in making the frame. In that case you will want half a dozen each of 6d and 3d wire nails, and some galvanized tacks (they do not rust the cloth). A few 1-inch wire brads are handy to hang kettles on pot-hooks, as they do not split the end of a green stick, but simple notches will do.

When traveling in company through a thickly wooded region, where the men may have to scatter to find a trail or a divide, it is good forethought for each of them to carry a whistle, the army pattern being a good one. Its note carries better than the voice, and it saves breath. Have a pre-arranged code of signals, such as *one note*: "I am here," *two*: "Come this way," and so on.

FEATHERWEIGHT KITS.—The outfit already listed may be considered of medium weight. A heavier one, for cold weather camping, will be suggested in Chapter IX. But what is the lightest equipment that will serve for tramping and camping,

decently, in civilized country? Many summer outers who enjoy walking and like to explore out-of-the-way places are interested in that question.

Well, what would you say of a ready-made camping outfit that weighs just 7 pounds? Tent, jointed poles, pegs, ground sheet, sleeping bag, air pillow, toilet articles, canvas bucket and wash-basin, spirit stove, cooking utensils—seven pounds to the very ounce; and the whole kit is so compact that it stows in a light rucksack, or a bicycle pannier, with room left for spare clothing and such food as is not bought along the route of travel. Total burden about 10 pounds, with which the lone pedestrian or cycle tourist is independent of hotels and boarding-houses!

I first heard of this campestral marvel in 1910, when a young Londoner wrote me for a dimensional sketch of a tomahawk I had recommended. A chatty correspondence followed that introduced me to a new Old World scheme of tent life very different from what I was used to, but one developed to the last line of refinement and full of canny tricks of the outers' guild.

For me it was an eye-opener to find the lightest camp equipments of the world in England, a nation I had always associated with one-ton "caravans" at home and five-ton "safaris" abroad. Verily here was the art of open-air life evolved to a type undreamed of in our own country.

Back of this development, I learned, were years of patient, thoroughgoing experiment by scores of men and women whose one fad (if it be a fad) was to perfect a camping kit that should be light, lighter, lightest, and yet right, righter, rightest. Then it came to me from faraway years that the father of modern lightweight camping was not the Yankee "Nessmuk," but the Scotchman Macgregor, who in 1865, built the first modern canoe, *Rob Roy*, and cruised her a thousand miles with no baggage but a black bag one foot square and six inches deep. It was said of Macgregor that he would not willingly

Featherweight camping in "civilized" fashion began with the *Rob Roy,* progressed with the flotillas of British and American canoeists who followed its skipper's example, was refined by the squadrons of cycle tourists and the pedestrian campers who scour the highways and byways of all Christendom in their yearly holidays.

To one whose camps have always been pitched in the wilderness the seven-pound English kit seems amusingly frail and inadequate. Such a one might exclaim in mock reverence, as my partner used to when he caught me modeling some new-fangled "dingbat": "Great and marvelous art thy works, Lord Geeminy Criminy!" But such an outfit is not meant for the wilderness. It is for the independent vacationist who wants to ramble off the beaten track, to see what conventional travelers always miss: the most interesting and picturesque places and peoples in their own and foreign countries.

European outfitters have been catering for years to this class of trade; but what have we done for it? Precious little. Whoever goes in for that sort of vacation must either pack around with him twice as much weight and bulk as there is any sense in, if he buys his kit ready made, or he must build an equipment for himself, which few tourists have either the time or the skill to do. Perhaps, then, this foreign cult may be worth looking into.

First, the featherweight kit already alluded to. It was designed by Owen G. Williams, and marketed by J. Langdon & Sons, Duke St., Liverpool. The constituent parts, with their weights, and prices before the war, are given below. If ordered together the price of complete outfit was £4 4s, or about $21.00.

SINGLE OUTFIT FOR PEDESTRIAN OR CYCLING TOURS

	Price	Weight
"Featherweight" tent complete	£1 10 0	2 8
Ground sheet and pegs for same......	0 4 3	15

"Comfy" sleeping-bag (eiderdown)...	2 2 0	1	4
Compact brush and comb and mirror.	0 1 9		2
Japanese rubbered air cushion	0 1 6		2
'Compleat" cooking outfit and stove.	0 3 6		15
Aluminum knife, fork and spoon.....	0 1 4		2
¼ pint aluminum flask and egg cup...	0 2 8		3
Enamelled cup, plate, and mop, per set	0 0 9		5
Canvas bucket and wash basin	0 2 3		6
Pole clips and candle holder	0 0 6		2
	£4 10 6	7 lbs.	

The tent is barely large enough for one man to sleep in: 3 feet high, 6 feet long, 3 feet wide on the floor, with front and rear extensions of 32 inches and 36 inches respectively. It is a modification of the common "A" or wedge pattern. The doorways are cut so as to peg out straight in front, affording an outside windshield for cooking. The back end is rounded for storage accommodation and to provide in the worst of weather for cooking without risk of spilling foodstuff on the ground sheet.

The top, which shields the sleeper, is made of "swallow-wing," unprocessed but rain-proof. The bottom portion of the tent is of a lighter material that helps ventilate, but still is spray-proof. The tent alone weighs 22 ounces, poles and case 10 ounces, pegs and lines 8 ounces. The tent rolls into a package 8½ inches long by 4 inches thick. The poles unjoint to a length of 23 inches.

I am assured that this midget shelter will stand up in a hurricane that overthrows wall tents, marquees, and the army bell tent. Enthusiastic campers use it even in winter, sleeping out without a fire when the tent sags heavily with snow. They find it satisfactory protection in torrents of gusty rain so fierce as to wet through a common tent in spite of the fly, by driving through the material of back or front. It has stood nine months' continuous service in Canada.

The ground sheet is of a special fawn waterproof sheeting, 5 feet by 3 feet, eyeletted at each corner, and with pegs to hold it down.

The sleeping-bag is shaped narrow at the foot to save weight and bulk, and is of the old-fashioned pattern closed with a draw-string. It is stuffed thinly with eiderdown, the warmest of all known materials for its weight and (rolled up) bulk. It has a thin rubbered cover bag, waterproof and windproof. For those who dislike the stuffiness of so small a "sleeping-pocket" the same outfitters provided down quilts of two sizes, the 6 x 4 foot size, with valance, weighing 3¼ pounds.

The air-pillow is a Japanese contrivance, incredibly light and compact. A reeded form, more comfortable than the plain oblong one listed with the set, is 12 x 10 inches, weighs only 2½ ounces, and three of them can be carried in a coat pocket when deflated.

Since the English camper seldom could get wood for fuel, or permission to make a fire in the open, he was obliged to carry a miniature stove and some alcohol or kerosene. In this instance it is an alcohol burner of common pad form, which is wasteful of spirits, but less likely to get out of order than an alcohol vapor stove. The cooking outfit is made up of two little kettles or deep stew-pans with handles, a miniature frying-pan, a toaster, a tea-ball, and the stove, all nesting in the outer kettle, which has a cover.

Another one-man outfit was designed and is (or was—I know not what the war may have done there) manufactured by that veteran camper and outdoor writer, T. H. Holding, of 7 Maddox St., London, W. It includes the following articles:

Tent	13	ounces
Poles (3)	15	"
Pegs	10	"
Ground sheet	10	"
Ground "blanket"	8	"
Down quilt	20	"
Cooking kit	16	"
	6	pounds

The "Wigwam," as Mr. Holding calls his tiny tent, is of ordinary "A" shape and is made of Japanese silk, 5 ft. 11 in. long, 4½ ft. wide, and 4 ft. high, giving sufficient headroom to lounge in comfortably. When rolled up it can be carried in an ordinary pocket. It will be noticed that the poles and pegs weigh practically twice as much as the tent itself. This is due partly to the use of shear poles in front, instead of a single vertical pole, giving freer entrance and egress, besides supporting the tent better. A ridge pole, weighing 10 ounces, is supplied extra, and is recommended for the sake of trim setting. The poles are of jointed bamboo, and the pegs of aluminum, flattened at the ends instead of pointed, to give a good grip in the ground.

Of the silk tent Mr. Holding says: "Such is its toughness that I have seen a pair of the strongest fingers try to tear the material, and fail. For its weight and thickness it is the most powerful stuff in the world in the shape of textile goods. I have put several tents I possess to protracted and severe tests, and I have never had one to tear. One has stood some of the heaviest rains, in fact, records for thirty hours at a stretch, without letting in wet, and I say this of an 11-ounce silk one. . . .

"What, however, silk does not stand well is *friction*. As an instance, open your silk umbrella and look down the folds, half way between each rib. The parts of a tent, therefore, which show the wear are at the pegging and head places, where the fingers touch it in erecting. To this end I recommend they should not be rolled up, as cotton fabrics, but rucked, like a pocket handkerchief."

The "Wigwam" is also furnished ready-made in various other materials, cheaper but heavier than silk, of which the next lightest is lawn, weighing 1 pound 8 ounces.

The ground sheet is of light mackintosh. Over it goes a little "ground blanket" of thin cashmere, with eyelets at the corners, so that it may be pegged down. This is not only for the sake of warmth,

but also to save wear on the mackintosh, which has to be very thin.

Mr. Holding's eiderdown quilt is only to cover with, not to roll up in. The Wigwam size is 5 ft. 10 in. by 4 ft., to which is added a foot of cloth valance all around, which is pegged or weighted down so that the sleeper will not kick off his covering. These quilts are thinner than the domestic ones of down, and roll up into remarkably small compass.

The cooking kit is made of thin copper. It includes a pad spirit stove with damper and windshield, a boiler 6 inches across, a porridge pan that fits inside, and a fry-pan that forms a cover for the boiler; also a separate handle for the various pans. The vessels are seamless.

Of course, this six-pound outfit does not include everything that a hiker requires in camp and on the march. Mr. Holding gives a list of articles recommended for two pedestrians traveling together:

	lbs.	oz.
"A" Tent, 6 ft. by 5 ft. 9 in. by 5 ft. 9 in.	2	0
Set of 2 tent poles	1	0
Set of pegs (ordinary skewers)		3
Oil stove—"Baby Primus"	1	3
Aluminum pans—"So Soon" pattern	1	1
Piece of waterproof for tent		2
2 Aluminum cups and saucers (plates)		4
2 sets Aluminum knife, fork, spoon		4
Candlestick and candle		2
Aluminum box of soap		1
	6	4

The piece of waterproof is two feet square. It is to roll up the tent in when wet, and serves otherwise as a wash-basin, seat, etc.

Each man carries half of this company kit, making his share 3 pounds 2 ounces. Adding his personal equipment, his burden becomes:

	lbs.	oz.
Share of baggage	3	2
Mackintosh coat	1	6
Air pillow		3

Down pillow (a luxury)		1
Sweater	1	0
Sleeping stockings (long ones)		6
Extra walking socks		4
Down quilt	1	10
Thin extra vest (undershirt)		5
Scarf		2
Tooth brush, etc.		3
Hold-all with straps (under)		8
	9	2

For hiking instead of cycling, a rucksack should be substituted for the hold-all. Adding a towel, the weight, without food, is close to 10 pounds, with part food 12 pounds.

The "Baby" kerosene vapor stove here listed is like a regular Primus except that its valve is in different position, the pump is set in snugly at the side, it has rounded cone feet set inward, and it is of reduced size, weighing only 1 pound 3 ounces instead of 4 pounds. A still smaller stove of the same pattern, called the "Pocket Primus," measures 2¾ inches deep by 4 inches across, when packed, and weighs only 1 pound 1 ounce.

Another specialty is the "So-Soon" cooking kit. The lower vessel is a boiler 3¾ by 5½ inches, the second is another boiler that fits inside the first, next is a stew or porridge pan which, inverted, makes a cover for the kit; on top is the frying-pan, 1 inch deep. All of these vessels are of stamped aluminum. A separate handle fits all of them. A "Baby Primus" stove fits inside the nested pans. The main boiler tapers narrower at the bottom, so as to keep the set from rattling when carried about. No part has any excrescence or projection to obstruct the packing. The whole set, omitting stove, weighs 1 pound 5 ounces.

There is a smaller "So-Soon" set made for the "Pocket Primus," which is 3½ by 5¼ inches, and its three vessels weigh only 8 ounces.

Returning to the subject of tents: the English outfitters supply them of many shapes and sizes and

in various lightweight materials, besides common tents, of course. It will strike American campers as peculiar that none of the extra thin materials used in tents up to 7 x 7 size are subjected to any waterproofing process whatever. For rain-shedding quality they depend solely, like an umbrella, upon the closeness with which the textile is woven. On examining these clothes one is surprised at their exceeding fineness of texture. Some of the cotton goods are woven almost twice as fine as our so-called "balloon silk" or the 4-ounce special Lowell cloth used for extra-light racing sails on small craft.

The best lawns, etc., are made from Egyptian cotton, which has a stronger and finer fiber than American cotton, and is said to be 15 per cent. stronger. In spite of this, I doubt if any thin, unprocessed tent is really rainproof unless it is stretched very taut and the occupant takes great pains to avoid touching it from the inside. In a shelter only three or four feet high, and wedge-shaped, one can hardly help rubbing against the interior, and then will come the *drip-drip* that we know too well. Even the rear wall, though vertical, will be rubbed by one's pillow in a very short tent, and then, if rain is driven by the wind, this wall will leak. The only remedy would be to waterproof the cloth or use a fly.

There is another objection to extremely thin tenting material: it requires tighter stretching, and hence more pegs, than stouter material would, or it will belly and sag. Moreover, it stretches excessively, and then the poles will no longer fit. Mr. Holding himself reports that a small tent stretches from three to nine inches, in service. Waterproofing would prevent nearly all of this, for it is the alternate tightening and loosening of the cloth from wetting and drying that makes the fiber of the material loosen up.

A feature of some of the English tents that deserves copying is the angular extension of lower edge of door flaps, so that the doors can be pegged out

straight in line with sides of tent, forming windshields and protection against driving rain when one wants the door open. Another is that the ground sheet, instead of being made square or rectangular, has the sides and rear end cut in segments of a circle, so as to fit against the walls when they are drawn outward by sagging of ridge and stretching of sides.

The bedding here described would not suit us at all. The down sleeping-bag would be too stuffy. The Holding quilts are so narrow that they can only be used to cover with, and so the under side of the body is left unprotected by anything but cold mackintosh and a very thin sheet of cashmere. In England, I suppose, it is taken for granted that the camper will procure, for each night, a bedding of straw or hay; but in our country there are many places, even in "civilization," where the camper would have to chance it on the bare ground. In our climate (or climates) we need more bedding under than over us, if there is nothing to serve as mattress.

The English featherweight outfits, although not adapted to our needs, are very suggestive, and American pedestrian tourists will do well to study them. (Full details are given in Mr. Holding's *Camper's Handbook*). Not only lightness but compactness seem to have been brought to an irreducible minimum. For example, there is a complete cycle-camping outfit for two men, including tent, down quilt, toilet articles, cooking utensils, etc., that stows in a bag only 15 x 7 x 7 inches!

CHAPTER VIII

PACKS FOR PEDESTRIANS

The simplest way to carry a light marching kit is in a blanket roll. It is made up as follows: Spread the shelter cloth or tent on the ground, fold the blanket once, end for end, and place it on top, with same amount of cloth left uncovered at front and rear. Divide the other equipment into two piles of equal weight, arrange one of these along one end of blanket, the other along the other end. Fold free sides of shelter cloth over all. Roll the whole affair as tightly and smoothly as possible, and secure with straps or cords, one at middle and one half-way to either end, making a roll about six feet long. Then fasten each end tightly with a slip-knot, leaving enough free cord on each to tie the ends of the roll together in horse-collar form. It takes two men to make a neat job of this.

The roll is worn over one shoulder with ends over opposite hip. Some pedestrians like the blanket roll because it saves the expense and weight of a pack-sack or harness, and because it can be shifted from one side to the other. In reality nothing is gained in ease of carrying, but rather the contrary. All the weight is thrown on one shoulder at a time, and there is no help from the hips. A man can carry a heavier load in a pack-sack with less fatigue in the long run.

The blanket roll is oppressive in hot weather, and its pressure on the chest is a handicap at all times. It is much in the way when one has to climb or crawl, and even more so when you go to shoot. It will not hold half the equipment mentioned in

my summer list, and if a haversack is added, you have a particularly irksome "flip-flop" to impede you, and the "advantage" of shifting weights is then lost. A blanket roll is suitable only for a day's hike and a one-night camp; even so, it is much less comfortable than a light pack on one's back.

PACK HARNESS.—I leave out of account simple tump lines and the like, because they are practical only for canoeists carrying heavy burdens across portages.

A pack harness is an arrangement of straps for carrying an outfit made up into a bundle inside the blanket, or for toting two duffel bags strapped side by side. The illustration (Fig. 23) shows one with tump or head-band added. If bags are not used, the bundle must be wrapped in a pack cloth of strong waterproof canvas (the tent or shelter cloth will not do, for it needs protection from rough usage). As to this method of packing I quote from the book on *Winter Camping* (Outing Handbooks) by Warwick S. Carpenter, who has had more experience with it than I:

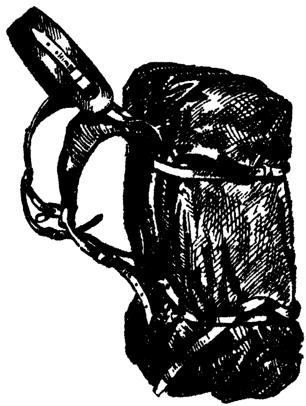


Fig. 23.—Pack Harness with Head Strap

"The arrangement that I have frequently used is that of the pack cloth, with the outfit and blankets or sleeping bag folded inside. Its flexibility for various sizes of load commend it strongly, and the pack cloth may be used as shelter besides, or as a ground cloth in a lean-to or tent. The method of making this pack is to lay the pack cloth on the ground and place the blankets or sleeping bag folded once on top of the cloth. Place the outfit as compactly as possible on the blankets or bag and fold it tightly in, making the bundle . . . consider-

ably longer than it is wide and thick. Then take the end of the pack cloth which runs along the bottom of the pack, and bend it up over the folded bundle. Next take the sides of the pack cloth and fold them over, or if there is much cloth, roll the whole pack over from side to side, keeping everything snug and tight.

This will leave the bottom of the pack cloth folded inside and the sides of the cloth lapping all around so that no snow or wet will sift in at the bottom. Fold the still open top down as a flap, just as you would the end of a paper package, with the folded flap at the side of the pack away from the back. Pass a rope or a strap lengthwise around the whole and then attach the harness with its shoulder straps or tump line. Such a pack is absolutely secure against snow or rain.

The best form of pack-harness is that which is made with a broad shoulder piece shaped like a sailor's collar, the wide bands of which run well over the shoulders and about eight inches down in front. From the back of the collar, about five inches apart, two vertical straps run downward about fifteen inches to the small of the back and bend up under the arms to meet the broad bands in front. There they are fastened with buckles, and the straps are made long enough to permit considerable taking up or letting out. Riveted horizontally to the straps behind, one at the height of the collar piece and the other fifteen inches lower, are two straps six feet long, which go around the pack. This harness may be bought of any dealer in camping outfits, but the collar portion of all that I have seen is made of heavy canvas. This very quickly wrinkles and draws up and cuts the shoulders. It is far better to have it made of a very heavy piece of leather.

One of these that I put together myself has been used for years and the broad bands that go over the shoulders are still as smooth and comfortable as when new. To the back of the collar should be riveted two short straps about six inches long, extending upward, as the others go downward. To these can be buckled a broad tump which goes over the forehead. It will be adjustable with the buckles or can be removed entirely."

The chief merit of this kind of pack is its adaptability to any size or shape of bundle. On the other hand, the weight of harness and pack cloth together (3¼ to 5 pounds) is considerably more

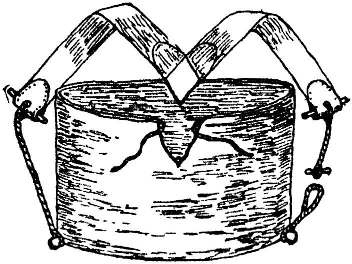
than that of a roomy pack-sack. True, the cloth can be used as a ground sheet under the blanket at night, but that is not needed if one has a sleeping-bag, or a browse-bag (and rubber cape to go over it when things are wet) which weighs but a pound and makes a far better bed. Pack cloths are made from 5 x 6 to 6 x 7 feet, which is too small for a shelter cloth. Another disadvantage is that whenever you want to get at anything in the pack, the whole thing must be undone and repacked.

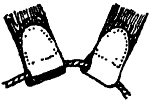
The tump or head-band is a good addition not only to a pack harness but to almost any other kind of pack used for carrying heavy weights. Generally it will not be used until the shoulders tire; then it relieves the strain. It is an advantage in climbing steep hillsides. When fording a swift stream, crossing on a foot-log or fallen tree, going over windfalls, crossing ice, or passing other dangerous places, the shoulder straps may be dropped, the head-strap alone being employed; then, if you slip or get overbalanced, the load can be cast off instantly by throwing back the head, and you save your bones or possibly your life. When the tump is not in use, drop it down over the chest.

Military Knapsacks.—In most European armies the infantry carry small knapsacks made of leather, stiffened with a framework of wood or bamboo, or reinforced at the sides to give a certain rigidity. Inside the knapsack are stowed spare underwear, fatigue shoes (if any), a reserve ration, spare ammunition, and various small articles. The blanket, or overcoat, is rolled tightly in a shelter half and strapped around the top and sides, and a mess kettle generally is strapped on the outside. In some models, as the German, the interior is divided into compartments to separate and protect the different articles and to assure a constant distribution of the weight.

A military knapsack is too small for campers, it is much too heavy for its size, and it obliges the wearer to carry most of his outfit outside, attached

come into vogue in our country for light mountaineering and for walking trips in settled regions. In tourists' patterns the opening is protected from dust and rain by a flap (Fig. 25), and one or two covered pockets may be added on the outside (Fig. 27) for such articles as may be wanted from time to time on the way. In its original form the rucksack is sketched in Fig. 26, which shows an open-mouthed bag of light cloth closed by a puckering cord.





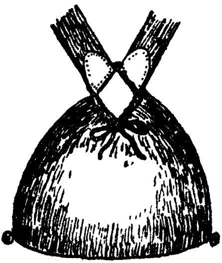


Fig. 26.—Plain Rucksack (after Payne-Gallwey)

The rucksack is distinguished from all other packs by the method of attaching its shoulder straps, which swing directly from the puckering cord at the top, and are fastened below by toggles, hooks, or buckles. (Fig. 25 shows another fastening by a cord tying into the shoulder strap with a looped knot; this is easily adjustable, and a tug at the end of the cord will loosen the pack instantly). The point of suspension, then, is in the center of the sack's top, instead of near the upper corners as on a military knapsack. This brings the strain over the strongest part of the shoulders, where it is least felt.

Since the rucksack is made of light cloth, with no stiffening, it is very capacious for its weight: one

that holds half a bushel can be rolled up and tucked into the pocket of a hunting coat. When filled with spare clothing and such other articles as would be carried by one who went afoot through well settled districts and put up for the night at inns or farmhouses, the weight of such a pack is hardly noticeable. On the hike, one's coat or cape, rolled up, may be carried under the flap. The plain rucksack, without flap, is easy to get into, since all you have to do is to pull one end of the puckering cord and the bag is wide open: this makes it handy as a game bag. The weight, being carried low and tight against the body, does not tend to overbalance one in difficult climbing—a point of consequence to mountaineers.

But the rucksack is a poor device for carrying such a kit as is required by one who sleeps out and totes his bed and shelter with him. Its contents bunch up into a rounded lump (see Fig. 27), and heavy articles work to the bottom. Everything gets jumbled up. Worse still, the pack "rides" so low that it presses hard against the small of the back, which is the worst of all places to put a strain on.


Fig. 27.—Rucksack in Use

I tried out the rucksack thoroughly, years ago. It is a good contrivance for carrying the day's necessities when you are reasonably sure of reaching a house or camp at night, being never in the way like a haversack or blanket-roll, yet more capacious. The one illustrated in Fig. 25, made of thin brown waterproof canvas, 21 inches wide by 22 inches high, weighs 12 ounces. Another outfitter supplies one of about the same size, in waterproofed olive-drab cloth, with an outside pocket, that weighs only 9 ounces. One of these is an excellent carrier for a feather-

weight camping kit, but for packs of over 15 pounds, I will have none of it.

An interesting modification of the rucksack, which brings the weight where it can best be borne, is the Norwegian army pack sack (Figs. 28, 29). In this the sack is united to a support of oak or ash, which comprises a horizontal wooden crosspiece (*A*) and two vertical pieces (*B, C*) curved to fit the back. Bag and frame are joined at the bottom by two rings, which are sewed on leather bands and attached to the horizontal piece of wood, at one end

Fig. 28.—Norwegian Knapsack in Use

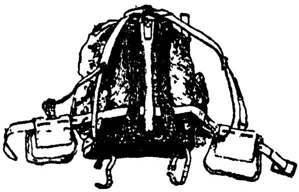


Fig. 29.—Norwegian Knapsack (Back)

by a spring placed on the traverse, and at the other by an eyebolt. At the top they are joined by a strap, one part of which is sewed on the middle of the back of the knapsack, the other, or free part, being passed through a slit made in the upper part of the support, and bent back and buttoned on itself.

The slings of the knapsack draw from the center, as in a rucksack, but are attached to a small arch-shaped brass piece riveted to the upper part of the support. Their free ends have hooks which engage in the eyes of eyebolts fixed at each end of the lower traverse of the frame. On each sling, at the height of the armpit, there is a double button on which is fixed a counter sling furnished with a brass hook.

which latter is hooked to the belt from the under side, helping to support cartridge pouches. The knapsack is 17½ inches high, 14½ inches wide, and weighs 3½ pounds. I have seen lighter ones made for civilians. The lower crosspiece rests above the hips, on the pelvis, which, the designer says, "is the most suitable part of our framework to support burdens." The shoulder straps have little more to do than keep the pack against the back.

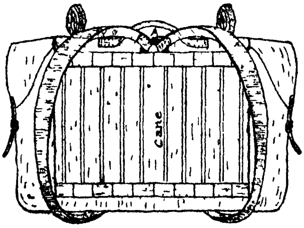


Fig. 30.—Tourist Knapsack (back)

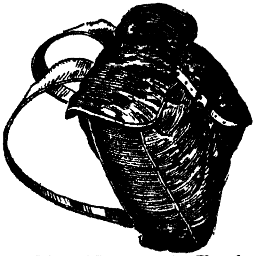


Fig. 31.—Nessmuk Pack Sack

Another and lighter way of stiffening a knapsack is to reinforce the sides and insert pieces of cane vertically in small pockets on the back (Fig. 30). This also allows air to circulate between the pack and the bearer's back, preventing excessive sweating. (When our old army knapsack was worn, in summer, men would sweat clear through the heavy canvas). The tourist's knapsack here illustrated is pliable and yet has enough rigidity to maintain a neat form. Of course, it is not suitable for carrying a heavy weight. In this case the slings are suspended centrally from a D-ring (*A* in the figure). A handle like that of a shawl-strap is provided, so that the knapsack may be carried like a satchel when one is in town. Straps on top are provided to carry the coat or cape.

Pack Sacks.—I use this term specifically to denote sacks that are roomy enough to take inside a whole outfit for the pedestrian or canoeist who camps out. It would be a waste of space to de-

scribe half the patterns that are listed by outfitters, as there are so many that are ill-designed. Three examples that have good "points" will suffice:

The so-called "Nessmuk" pack sack (he did not design it) is shown in Fig. 31. It is made of medium-weight brown waterproof canvas. The bag has boxed sides that taper from about 5 inches width at bottom to 3 inches at top (not shown in illustration) and it is about 3 inches narrower at the top than at the bottom. To the top edge of the bag proper is sewed a throat piece like that of a duffel bag. When the bag has been packed, this throat piece is gathered together and tied like the mouth of a grain sack, so as to exclude water. You may take a header while fording a stream, or capsize your canoe, without getting water inside the pack. The extension also allows the sack to be packed fuller than normal, so that when carried the pack rises as high as one's collar. It is somewhat in the way when one is making up his pack, but, when tied, there is no risk of losing anything out of the bag.

This pack sack carries higher, and hence more comfortably, than a rucksack. It will contain a light camping equipment, say one of twenty pounds. The slings draw from the center, but are somewhat over 2 inches apart at top of pack, and so do not pucker the bag so much, nor throw its top so far backward, as if they drew straight from a D-ring.

The common pattern of "Nessmuk" pack has light web shoulder straps, which are an unmitigated nuisance: they wrinkle up and cut like ropes. Get the better grade with leather straps. I have one of this kind, 20 inches wide by 15 inches high, that weighs 2 pounds 2 ounces. It would be better if the throat piece were a couple of inches longer. The buckle for the flap strap should be placed as high as the upper hole of the strap. There is a similar sack 5 x 16 x 18 inches, with an outside pocket almost the size of the face of the pack, which, with leather slings, weighs only 24 ounces.

For regular packing, when one sleeps out, the best pack sack at a moderate price that I know of is what is known as the Duluth, or, from its inventor, the Poirier pattern (Fig 32). Originally made for trappers, timber cruisers, and other professional woodsmen, it is now used by many sportsmen as well. The Duluth sack has no boxed sides, but is sewed up in the form of a simple bag, and so is made wider and higher than boxed ones of equal capacity.

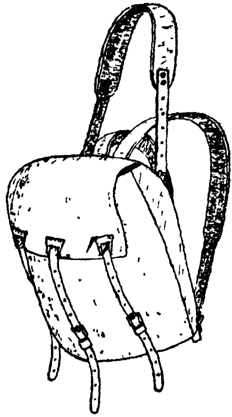


Fig. 32.—Duluth Pack Sack

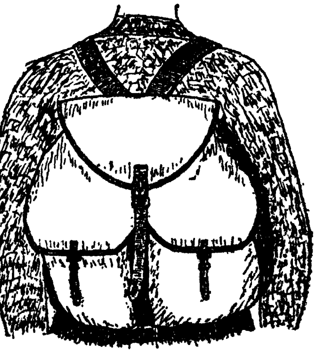


Fig. 33.—Whelen Pack Sack

The advantage is that one's blanket, which goes in first, as a pad for the back, can be folded two feet square, or a little more, and consequently in fewer thicknesses; hence the bag packs flatter than a boxed one and does not bulge so far backward at the top. Poirier makes his pack sacks in three grades: (*A*) 12-oz. duck, heavy grain leather shoulder straps and canvas head strap, all straps and buckles fastened with copper rivets and burrs; (*B*) 10-oz. duck, canvas shoulder and head straps; (*C*) 10-oz. duck, canvas shoulder straps, no head strap. By all means get the *A* grade, as canvas slings will

wrinkle when wet and cut the shoulders. The standard sizes and weights, in *A* grade, are as follows:

No. 1.	24 x 26 inches.	2¼ lbs.
No. 2.	26 x 28 inches.	2½ lbs.
No. 3.	28 x 30 inches.	2¾ lbs.

For a pedestrian the No. 1 or No. 2 is large enough. A canoeist will find one of the larger ones ample to hold all the duffel for a single-handed cruise, and a week's provisions; but if he chooses to carry more on the outside, then, when he comes to a portage, the surplus articles can be piled on top of the pack, the head strap will be put to use, and he can tote as much as with a tump line, or more, because the shoulders assist.

The shoulder straps of the Duluth sack start from a common center, where they are riveted to an inside piece of leather. They fork from between one's shoulder blades like a pair of suspenders. The flap is half as long as the sack, and it is fitted with three *long* straps whereby the sack may be adjusted snugly to a large or small load. As the sack has a wide mouth, it is easy to pack and to get into. The three straps hold down the flap closely at the corners as well as in the center, and so keep out rain and snow and prevent things spilling out. There is no throat piece; but a wise woodsman stows his perishables in light waterproof bags, anyway.

The pack designed by Captain Townsend Whelen, U. S. A., has an ingenious arrangement for regulating the size of the bag according to what is carried. It consists of a many-gored bag (Fig. 33), about 18 inches wide by 22 inches long without the gores. The bag can be let out enough to carry a small deer, feet up, or, by means of a strap that goes around it from top to bottom, it can be triced up, gores folded inside, until there is nothing of it but a little knapsack for carrying one's daily equipment. There are two roomy pockets on the outside, one of them, for the camera, made so that

no water can get into it. The arrangement of straps is such that all the strain is put on them instead of on the canvas. Made of 12-oz. waterproof khaki duck, the Whelen pack sack weighs 2⅜ pounds.

COMBINATION PACK SACKS.—Since "an ounce in the morning is a pound before night" when one goes afoot, and "a mile uphill is five on the level," many ingenious contrivances have been devised to make one article in the outfit serve two or more purposes. So we have various combinations of pack and tent, pack and sleeping-bag, pack and stretcher-bed, and so forth. Though I do not go so far as the old-timer who averred that "all combination tricks are pizen," yet I am apt to be rather shy of them. An article can serve two purposes, but it can't do them both at the same time, and in either case it is likely to be a makeshift.

If a pack does not "ride" just right, or if it is not easy to fill and easy to get into at any time, it is faulty. If the tent, or the sleeping-bag, or the stretcher-bed, is altered from what it should be to accommodate it to some other use, it is vexatious. Most of these inventions defeat their own purpose by being almost, if not quite, as bulky and heavy as the separate articles would be if made right. For instance, you can use a sleeping-bag as a pack to stow your duffel in, but to carry it you must have a harness of some sort, and that harness will weigh over a pound. I would rather tote an extra pound and have a pack sack, for it is so much more convenient. The notion that a sack is good for nothing in camp is wrong; you need a receptacle for everything that is not in present use, lest things get scattered and lost. Or, if long training has made you habitually careful in such a matter, you may do with that sack as I often do; turn it inside out, stuff it with dry leaves, put it under your filled pillow-bag, and sleep with your head comfortably high.

PACK BASKETS.—In the forests of the northeast-

ern states and in the maritime provinces of Canada, a favorite carrier is the pack basket, made smaller at the top than at the bottom, flattened on the back, and provided with a cover. An average size is about 18 inches high, 17 inches wide at the bottom and 15 at the top, by about 12 inches deep. Various sizes can be bought from outfitters in the cities, who also supply them with waterproof canvas covers (Fig. 34). One of the latter kind, holding 1¼ bushels, weighs 4¾ pounds. A larger one, 18¾ inches high by 18 by 14½ inches, weighs 7 pounds;

Fig. 34.—Pack Basket (covered)

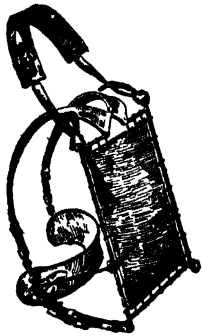


Fig. 35.—Abercrombie Pack Frame

it fastens with lock-buckle and strap. Uncovered baskets weigh from 2½ to 5 pounds, according to size. Common ones generally are too small at the top for easy stowage of bulky articles; but if the basket is made more than 12 inches deep it will drag back unmercifully on the shoulders.

To my notion, the best that can be said of the pack basket is that it is a bully thing in which to carry canned and bottled goods—when some other fellow does the toting. It is too heavy, too abrasive, and too bothersome in the brush and thickets, for average foot travelers, and it does not stow so well in a canoe as a pack sack of equal capacity.

Pack Frames.—The far Northwest has another

pet rig for the "human beast of burden": the pack frame. In its simplest form this consists of two vertical or slightly flaring pieces of wood joined by cross-bars near the top and bottom, covered with a sheet of canvas, and fitted on one side with broad straps for the shoulders, on the other with straps, ropes, or thongs, for tying on the load. One model has a little skeleton shelf on the back, near the bottom, for the pack to rest on, this shelf being fitted with hinged metal supports so it can be folded down when not in use. Such a frame leaves an air space between the body and the pack, and so does not sweat the carrier's back like a knapsack. A load of any size or shape can easily be fixed on it. The weight is comfortably balanced and divided between shoulders and hips. The upright pieces of wood are of such length that their lower ends support the whole load when the man sits down to rest, as on a log, for instance.

Figure 35 shows a new invention in pack frames, by D. T. Abercrombie. In this the frame, and consequently the load, is kept quite away from the lower part of the back, being joined to a hip strap by a rod with horizontal arm on each side. There is a tump strap, as well as shoulder straps. Heavy weights can be carried with this contrivance, and, no matter how hard or irregular the load may be, it cannot hurt the back. The frame complete weighs only 2½ pounds.

Pack frames are not suitable for ordinary pedestrian trips, of course, but have such merit for portaging heavy and hard or sharp-cornered baggage that I mention them here, while on the subject of packing on human backs and shoulders.

Canteens.—One may travel where water is hard to find, though this seldom is the case in a timbered region. The best canteen is one of aluminum, which neither leaks nor rusts like the old-fashioned tin affairs. It should have a canvas cover with felt lining. When the felt is wet its moisture cools the water in the canteen by evaporation. The can-

vas cover prevents too rapid evaporation, and keeps the canteen from wetting one's clothing. At night, or in case of illness, the thing can be used as a hot-water bottle, the insulation keeping the water hot for a considerable time. The best pattern is the present regulation army canteen, which is shaped like a flat flask, but with one side rounded a little and the other concaved to fit the body. It has a flat bottom, so you can stand it up. The aluminum screw-cap, held by a chain, cannot jolt out like the corks of common canteens.

To cleanse the vessel, boil it. To sterilize suspected water, fill the naked canteen and place it, unstoppered, on the fire till the water boils. The army model holds one quart, and weighs 11 ounces. It can be bought from some outfitters, either with or without an aluminum cup that fits over the bottom. It is rigged to carry on the belt, where it will not flop nor pound the wearer. To draw it from its cover, turn two little thumb-screw fasteners half a turn, and you can whisk it out almost as easily as you would a pistol.

Aluminum is not fit to carry liquor in; but, for that matter, neither is tin. One of my old partners and I, on a voyage to the Arkansas swamps, once hit upon what we conceived to be a brilliant scheme for transporting a gallon of whiskey inconspicuously in our John-boat. (You know whiskey warms the hearts of otherwise disobliging natives—yes indeedy). We got a new kerosene can, had a tinner remove the spout and solder a patch of tin over it; then in went Old Taylor. We didn't open that can for a week (hadn't seen any natives). Then along came the dickens of a cold rain, and, when it ceased, we declared an "emergency." Well, what do you think? That whiskey had turned as black as ink. *Potztausend himmel donnerwetter!* or words to that effect. If anybody doubts that we didn't open that stuff for a week, I refer him to S. D. Barnes, captain of said John-boat, of which I was crew.

In mountaineering it often happens that one plans

to camp on or near the summit, and wants to carry water with him from some head spring, to save a long climb down after it. A large canteen would be cumbersome. A half-gallon rubber water-bottle solves the problem. It weighs less than a pound, and takes up little room in the pack. In cold weather, such a bottle, filled with hot water, may save packing the weight and bulk of an extra blanket.

CHAPTER IX

HOW TO WALK—A HUNTER'S PACK—GOING ALONE

In walking through a primitive forest, an Indian or a white woodsman can wear out a town-bred athlete, although the latter may be the stronger man. This is because a man who is used to the woods has a knack of walking over uneven and slippery ground, edging through thickets, and worming his way amid fallen timber, with less fret and exertion than one who is accustomed to smooth, unobstructed paths.

How to Walk.—There is somewhat the same difference between a townsman's and a woodsman's gait as there is between a soldier's and a sailor's. It it chiefly a difference of hip action, looseness of joints, and the manner of planting one's feet. The townsman's stride is an up-and-down knee action, with rather rigid hips, the toes pointing outward, and heels striking first. The carriage is erect, the movement springy and graceful, so long as one is walking over firm, level footing—but beware the banana-peel and the small boy's sliding-place! This is an ill-poised gait, because one's weight falls first upon the heel alone, and at that instant the walker has little command of his balance. It is an exhausting gait as soon as its normally short pace is lengthened by so much as an inch.

A woodsman, on the contrary, walks with a rolling motion, his hips swaying an inch or more to the stepping side, and his pace is correspondingly long. This hip action may be noticed to an exaggerated degree in the stride of a professional pedestrian; but the latter walks with a heel-and-toe step, whereas

an Indian's or sailor's step is more nearly flat-footed. In the latter case the center of gravity is covered by the whole foot. The poise is as secure as that of a rope-walker. The toes are pointed straight forward, or even a trifle inward, so that the inside of the heel, the outside of the ball of the foot, and the smaller toes, all do their share of work and assist in balancing. Walking in this manner, one is not so likely, either, to trip over projecting roots, stones, and other traps, as he would be if the feet formed hooks by pointing outward. The necessity is obvious in snow-shoeing.

A fellow sportsman, H. G. Dulog, once remarked: "If the Indian were turned to stone while in the act of stepping, the statue would probably stand balanced on one foot. This gait gives the limbs great control over his movements. He is always poised. If a stick cracks under him it is because of his weight, and not by reason of the impact. He goes silently on, and with great economy of force. . . . His steady balance enables him to put his moving foot down as gently as you would lay an egg on the table."

There is another advantage in walking with toes pointing straight ahead instead of outward: one gains ground at each stride. I have often noticed that an Indian's stride gains in this manner, as well as from the rolling motion of the hips. The white man acquires this habit, if he ever gets it, but an Indian is *molded* to it in the cradle. If you examine the way in which a papoose is bound to its cradle-board, this will be made clear. Immediately after birth the infant is stretched out on the board, its bowlegged little limbs are laid as straight as possible, and the feet are placed exactly perpendicular and close together before being swaddled. Often the squaw removes the bandages and gently drags and works on the baby's limbs and spine to make them as straight as possible. Then, in rebandaging, care is always taken that the toes shall point straight forward.

The woodsman walks with a springy knee action. There is a "give" at every step, and in going downhill the knees are bent a good deal, as they are when one carries a heavy burden. It is said of the Indian "he does not walk, he glides." No Indian glides in boots, but put him in moccasins and the word does express his silent, rhythmical, tireless, sure-footed progress, an admirable example of precision of movement and economy of effort. A white man acquires somewhat the same glide after getting used to moccasins, and especially after some experience on snowshoes, which compel him to walk with toes pointed straight ahead or a little inward.

OVER-STRAIN.—When carrying a pack on your back, do not over-exert yourself. Halt whenever your breathing is very labored or exertion becomes painful. Nobody who understands horses would think of driving them ahead when they show signs of distress, and there is quite as much common sense in treating yourself with the same consideration, if you want to travel far. Rig your pack at the start so it can be flung off whenever you sit down for a moment's rest; it pays. But don't halt more than three to five minutes. Long halts eat up daylight; they stiffen the muscles; and they cause chills and colds. Over-exertion is particularly disastrous in mountain climbing.

Not only in marching but in other labors, go steadily but moderately. Do not chop to the point of exhaustion, nor strain yourself in lifting or carrying. A feat of "showing off" is poor compensation for a lame back.

One who is unused to long marches may get along pretty well the first day, but on the second morning it will seem as if he could not drag one foot after the other. This is the time when the above remarks do not apply; for if one uses the gad and goes ahead he will soon limber up. But by the morning of the third day it is likely that complications will have set in. The novice by this time is worn, not only from unaccustomed exertion, but from loss of

sleep--for few men sleep well the first night or two in the open. He is probably constipated from change of diet, and from drinking too much on the march. More serious still, he probably has sore feet. This latter ailment is not so much due to his feet being tender at the start as from his not having taken proper care of them. Aside from the downright necessity of seeing that one's shoes and stockings fit well, and that the shoes are well broken in before starting, there are certain rules of pedestrian hygiene that should be observed from the word "go."

Care of the Feet.—"An ounce of prevention is worth a pound of cure." I have already said a good deal about the choice of shoes and stockings (Vol. I., Chapter IX). Let me add another reason for wearing heavy but soft woolen socks when you are in the wilderness, regardless of season; they ventilate the shoes. You probably will be wearing rather heavy shoes coated with some waterproofing preparation. The pores of the leather are filled so that no air can get through. But one's feet cannot be kept in good condition if the shoes are not ventilated somehow. Thick socks do it in this way: when your weight is thrown on one foot as in stepping forward, the air that was confined in the meshes of the fabric is forced out through the shoe tops (but not through a high laced boot); then, when the pressure is relieved, fresh air is sucked back to fill the partial vacuum. Thin socks, especially cotton ones, become saturated with perspiration, and little or no air can get into them at all: then the feet have their pores clogged and they become tender. Thin hose also admit sand and dirt more readily than thick ones.

One's feet can be toughened and hardened before starting on a hike by soaking them for some time, the night before, in a solution of alcohol and salt, or in one made by dissolving a tablespoonful of tannic acid in a wash-bowl of cold water. (*American Red Cross Text-Book on First Aid.*) A little alum in water may be substituted.

Every morning before starting on a hike, rub some talcum powder over the feet and dust some inside your shoes. One's underwear should also be dusted with it at all places where the garments are likely to chafe. If you have no talcum, then rub the feet with vaseline, melted tallow from a candle, or oil. Soap often is used for the purpose, but some soaps contain too much free alkali, which is bad for the skin; Castile or Ivory soap is not objectionable.

But the main thing is to keep the feet clean. Wash them well every evening, preferably in hot salted water. If they are strained, swollen, or hot, the best treatment is to rub them with alcohol or whiskey, but hot salted water and massage will do very well. Keep the nails cut close and square.

If the feet are washed in the morning, or when resting on the march, it should be done briskly, not by soaking, and they should be thoroughly dried, otherwise they will be tender. In winter, if water is hard to get, the feet may be cleansed by rubbing them with snow.

Should you step in water over your shoe-tops, or in any other way get the feet sopping wet, stop as soon as you can and wring out the hose; do not "walk them dry," for that makes the skin tender.

As soon as a blister is discovered, it should be opened *in the right way,* so that the skin may not be rubbed off and infection ensue. Sterilize a needle by holding it in the flame of a match. When it has cooled, prick the blister, not directly, but through the skin at the side, and gently press out the fluid till the blister is flat. Then put a light pledget of absorbent cotton on it, or a little square of sterilized gauze, and over this strap a bit of adhesive plaster. A second similar strap may be stuck on top of this in the opposite direction. Such a dressing keeps the skin from rubbing off, prevents infection, and enables you to travel on without inconvenience. A raw blister is treated in the same way, but a little Resinol or carbolized vaseline smeared on it with

a clean splinter, before the pad is applied, will help it to heal.

When walking long distances, it is a wise plan to change feet with one's socks at noon.

Cramps in the leg muscles are best treated by massage.

Thirst.—In warm weather, one's first few days on the march will bring an inordinate thirst, which is not caused by the stomach's demand for water, but by a fever of the palate. This may be relieved somewhat by chewing a green leaf, or by carrying a smooth, non-absorbent pebble in the mouth; but a much better thirst-quencher is to suck a prune or carry a bit of raw onion in the mouth. One can go a long time without drinking if he has an onion with him; this also helps to prevent his lips from cracking in alkali dust.

Drink as often as you please, but only a sup or two at a time. Sip slowly, so as not to chill the stomach. If one drinks till he no longer feels thirst, he is likely to suffer first from "cotton mouth," and then from the cramp of acute indigestion.

Never try to satisfy thirst by swallowing snow or ice; melt the snow first by holding it in the mouth, if no fire can be had. It is best to eat a cracker or something with it, as snow water is bad on an empty stomach.

To Avoid Chill.—Wear a woolen undershirt (woolen gauze for summer). Do not sit around when overheated and damp from perspiration, unless you have a sweater or extra wrap of some sort to put on. Do the same when reaching the top of a mountain, or other place exposed freely to the wind. But do not muffle up on the march.

Mountain Climbing.—The city man's gait, to which I have already referred, is peculiarly exhausting in mountain-climbing. He is accustomed to spring from the toe of the lower foot, in going uphill. That throws nearly the whole weight of the body upon the muscles of the calf of the leg,

a misadjustment of strain that would soon wear out even a native mountaineer. The latter walks uphill with a woodsman's gait, planting the whole foot on the ground, and swinging or rolling the hip at each stride, thus not only gaining an inch or two in his pace, but distributing the strain between several groups of muscles. When going downhill, bend the knees considerably so that the leg forms a spring to land on at each stride.

In Dent's *Mountaineering* are given some useful hints to climbers that I take the liberty of condensing here:

In walking up a steep hill, go slowly and steadily. If you cannot talk without catching your breath, it is a sure sign that you are going too fast.

If you slip on a loose stone, do not try to recover your lost ground quickly, but slip away until your foot is checked a few inches below. Thus keep up the rhythm of your footfall.

On an average mountain, where the slope is tolerably uniform, and the climber has no long journey before him, an ascent of 1,000 ft. in an hour is quick walking. In beginning a long climb, 800 ft. of vertical ascent in an hour is good work. On a good trail, for a moderate distance, 1,500 ft. an hour is quick walking. Under favorable conditions a good climber can ascend from a height of 7,000 ft. to 14,000 ft. in seven hours; at greater altitudes the pace will slacken.

In descending a mountain, the pace, however slow, should be continuous. To remain stationary, even for a moment, not only necessitates a fresh start, but demands an adjustment of balance which implies an unnecessary outlay of muscular effort. To descend rapidly and safely without exertion, a certain looseness of joints should be cultivated. On a steep slope one should descend sideways, so that the whole length of the foot can be planted fairly on any hold that offers.

A man will never sprain his ankle when he expects to do so at any moment, nor will he be likely to slip if he is always prepared to fall.

A Hunter's Pack.—Returning to the subject of outfitting: I have, so far, considered only summer travel afoot. There are many who go out in the

fall of the year, hunters especially, and who may wish to make side trips on their own hook. Captain Whelen has stated their case convincingly:

"There is much to be said in favor of back-packing. It increases many fold that sense of absolute freedom which is one of the fundamental reasons why men try to escape from civilization for a time. There is none of that trouble and worry that we all experience when we have the responsibility of a pack-train. I admit that back-packing, especially in a mountainous country, is downright hard work; but it's work worthy of a man; and once you get into a game country, you have very much less work than has he who must be continually watching and caring for a band of horses. Moreover, the back-packer usually has better success. He drops into a new country quietly and unseen. There is none of that clatter of hoofs, jingle of horse-bells, and noise of chopping. Before the game comes to know that there is a human being in the country, he has had his pick. . . .

The problem of transportation on a western big-game hunt is a constant one. The country is open, and one locality soon becomes hunted out. The reports of the rifles, the sound of axes, and the shouts as the horses are daily driven to camp, soon cause the game to leave for more healthful country. Hence camp must be moved from ten to twenty miles every three or four days. It has always seemed that one could hunt longer in one locality, and make these short journeys more easily, if he could forsake the pack-train for the back-pack. The latter method is a necessity when one wants to hunt a country inaccessible to horses. On some of my most successful hunts, from the standpoints both of recreation and of heads, I have hired a packer to take me in and bring me out, but in the meantime have carried my entire hunting where I would."

We may add that back-packing is the cheapest possible way to spend one's vacation in the wilderness.

The man who goes out alone for a week or so in the fall of the year, or at an altitude where the nights always are cold, should be fit to carry on his back from 40 to 50 pounds at the outset—of course the pack lightens as he consumes rations. I am not

including weight of gun, cleaning implements, and ammunition. He should wear woolen underwear of medium weight, thick and soft woolen socks, army overshirt, kersey or moleskin trousers, leather belt with pockets (not loops) for clips or loose cartridges, hunting shoes of medium height for ordinary use, felt hat, and, at times, buckskin gloves. In his pack there would be a spare suit of underwear and hose, a cruiser or "stag" shirt of best Mackinaw, moccasins or leather-topped rubbers, and German socks. In pockets and on the belt he would carry the same articles mentioned in my summer hiking list.

A mere shelter cloth is too breezy for this season (there will be no opportunity to build a thatched camp, as the hunter will be on the move from day to day). He needs a half-pyramid tent, say of the Royce pattern (Vol. I., pp. 85-91) but somewhat smaller, and weighing not over 4 pounds.

Bedding is the problem; a man carrying his all upon his back, in cold weather, must study compactness as well as lightness of outfit. Here the points are in favor of sleeping-bag *vs.* blankets, because, for a given insulation against cold and draughts, it may be so made as to save bulk as well as weight. For a pedestrian it need not be so roomy as the standard ones, especially at the foot end. Better design one to suit yourself, and have an outfitter make it up to order, if you have no skill with the needle. An inner bag of woolen blanketing, an outer one of knotted wool batting, and a separate cover of cravenetted khaki or Tanalite—the weight need not be over 8 pounds complete. Your campfire will do the rest. A browse bag is dispensed with, for you will carry an axe and can cut small logs to hold in place a deep layer of such soft stuff as the location affords.

The short axe may be of Hudson Bay or Damascus pattern. There should be a small mill file to keep it in order, besides the whetstone.

The ration list is based on the assumption that the

hunter's rifle will supply him, after the first day or two, with at least a pound of fresh meat a day. If it does not, go elsewhere. There are plenty of good ways to cook without boiling, stewing, or roasting in an oven (see Vol. I.), which are processes that require vessels too bulky for a foot traveler to bother with.

Either the Whelen pack sack or a large Duluth one will carry the whole outfit. Both have the advantage that they can be drawn up to smaller dimensions as the pack decreases in size, or for carrying the day's supplies when most of the outfit is cached at or near camp.

The following outfit is complete, save for gun, ammunition and cleaning implements. For a longer trip than one week, a reserve of provisions can be cached at some central point in the hunting district.

AUTUMN OUTFIT

	bs.	oz
Pack sack, with tump strap	2	12
Tent	4	
Sleeping-bag	8	
Pillow bag*		3
Rubber cape*	1	5
Mackinaw stag shirt	1	8
Spare underwear, 1 suit	1	8
Spare socks, 2 pairs		5
Moccasins	1	
German socks		12
Axe and muzzle	1	12
Cooking kit, dish towel, tin cup*	2	2
Cheese cloth		2
Mill file, 6 in.		2
Whetstone*		2
Pliers*		4
Wallet, fitted*		6
Twine*		2
Toilet articles*		6
Talcum powder*		2
Toilet paper*		1
First aid kit*		5
Spare matches, in tin		6
Alpina folding lantern		8
Candles, ½ doz.		8

Emergency ration		8
Tobacco, in wpf. bag		8
Spare pipe		3
Total pack without provisions	28	12

ONE WEEK'S RATIONS (not including fresh meat)

Flour	4	
Baking powder		4
Meal, cereal	1	8
Milk powder		8
Butter		8
Bacon	2	
Egg powder		8
Raisins		8
Dried apricots, prunes	1	
Sugar	1	
Chocolate		12
Coffee		8
Tea		2
Salt		4
	13	6
Provision bags, etc.		10
	14	
Pack complete	42	12

The articles starred (*) are same as in summer hiking list already given.

Moccasins are to be large enough to fit over the German socks. This foot-gear is used in still hunting in dry weather, and on cold nights. The camper sleeps, when it is frosty, in fresh underwear and socks, army shirt (dried before the fire after the day's use), trousers, stag shirt, neckerchief rigged as hood, German socks, and moccasins. When he has to get up to replenish the fire, or in case of any alarm, he springs from his bed attired *cap-a-pie*.

Many a time I have gone for a week's hunt, high up in the mountains, in bleak November, with much less outfit than is here listed. My native companions went even lighter than I. Often they slept out on the mountainside without shelter or

blanket, when the winter fog coated every twig in the forest with rime, and frost sprang up from the ground in feathery forms three or four inches high. We grinned at all that, and fancied that we were playing the game like men. So we were, but not like sensible men. We were sapping our vitality. Had we gone fixed to be well fed by day, warm and dry at night, and clean enough not to have smelt like a monkey's nest, we would have been playing a better game. *A-loo,* it is gone—and I am done.

GOING ALONE.—I have given a good deal of space to the subject of outfitting for single-handed cruising in the wilderness, because, as I have said, it is a difficult art, and anyone who masters it can easily fit up a company kit for two or more. But why go alone? To the multitude, whether city or country bred, the bare idea of faring alone in the wilds for days or weeks at a time is eerie and fantastic: it makes their flesh creep. He who does so is certainly an eccentric, probably a misanthrope, possibly a fugitive from justice, or, likely enough, some moonstruck fellow whom the authorities would do well to follow up and watch.

But many a seasoned woodsman can avow that some of the most satisfying, if not the happiest, periods of his life have been spent far out of sight and suggestion of his fellow men.

From a practical standpoint there are compensations in cruising the woods and streams alone, and even in camping without human fellowship. You get the most out of the least kit. It simplifies the whole business of camp routine. It would be piggish, for example, for two men to eat out of the same dish; there must be three at least, one to cook in and two for serving the food; but for one man to eat from his own frying-pan is not only cleanly but a sensible thing to do. It keeps the food hotter than if transferred to a cold plate, and saves washing an extra dish, an economy of effort that is the most admirable of all efficiencies!

The problem of cuisine is reduced to its lowest

terms. You cook what *you* like, and nothing else; you prepare what you need, and not one dumpling more. It is done precisely to your own taste—there is a world of gustatory satisfaction in that. You bake a corn pone, let us say, leaving the frying-pan clean of grease. You cut your venison (the flesh of all game is venison) into cubes and broil these on a sharpened stick, one at a time, just as you eat them, which is the best and daintiest cooking process in the world. Your coffee, settled by a dash of cold water, is drunk from the same cup you brewed it in.

Then comes the cleaning up. No more bugaboo of dishwashing, which all men so cordially despise. You give pan and pannikin a rinse and a wipe, jab your knife into the ground and draw it through some fresh leaves, chuck the broiling-stick into the fire, and—*voila,* the thing is done, thoroughly and neatly done, without rising from your seat!

So with other camp chores, from pitching the miniature tent to packing up for the march: everything is simplified, and time and effort are saved.

From a selfish standpoint, the solitary camper revels in absolute freedom. Any time, anywhere, he can do as he pleases. There is no anxiety as to whether his mates are having a good time, no obligation of deference to their wishes. Selfish? Yes; but, *per contra,* when one is alone he is boring nobody, elbowing nobody, treading on nobody's toes. He is neither chiding nor giving unasked advice. Undeniably he is minding his own business—a virtue to cover multitudes of sins.

A companion, however light-footed he may be, adds fourfold to the risk of disturbing the shy natives of the wild. By yourself you can sit motionless and mutely watchful, but where two are side by side it is neither polite nor endurable to pass an hour without saying a word. Lonesome? Nay indeed. Whoever has an eye for Nature is never less alone than when he is by himself. Should a strain of poetic temperament be wedded to one's

habit of observing, then it is more than ever urgent that he should be undisturbed; for in another's presence

"Imagination flutters feeble wings."

Solitude has its finer side. The saints of old, when seeking to cleanse themselves from taint of worldliness and get closer to the source of prophecy, went singly into the desert and bided there alone. So now our lone adventurer, unsaintly as he may have been among men, experiences an exaltation, finds healing and encouragement in wilderness life.

When twilight falls, and shadows merge in darkness, the single-handed camper muses before the fire that comforts his bivouac and listens to the low, sweet voices of the night, which never are heard in full harmony save by those who sit silent and alone.

Then comes the time of padded feet. Stealthy now, and mute, are the creatures that move in the forest. Our woodsman, knowing the ways of the beasts, regards them not, but dreams before the leaping flames like any Parsee worshipping the fire.

Weird shapes appear in the glowing coals. Elves dance in the halo where night and radiance mingle.

Hark to Titania!

"Out of this wood do not desire to go:
Thou shalt remain here, whether thou wilt or no.
I am a spirit of no common rate;
The summer still doth tend upon my state;
And I do love thee."

Ah, precious even the ass's noll, if by that masque one shall enter the fairy realm!

CHAPTER X

CONCENTRATED FOODS

The first European settlers in this country were ignorant of the ways of the wilderness. Some of them had been old campaigners in civilized lands, but they did not know the resources of American forests, nor how to utilize them. The consequence was that many starved in a land of plenty. The survivors learned to pocket their pride and learn from the natives, who, however contemptible they might seem in other respects, were past masters of the art of going "light but right." An almost naked savage could start out alone and cross from the Atlantic to the Mississippi, without buying or begging from anybody, and without robbing, unless from other motives than hunger. This was not merely due to the abundance of game. There were large tracts of the wilderness where game was scarce, or where it was unsafe to hunt. The Indian knew the edible plants of the forest, and how to extract good food from roots that were rank or poisonous in their natural state; but he could not depend wholly upon such fortuitous findings. His mainstay on long journeys was a small bag of parched and pulverized maize, a spoonful of which, stirred in water, and swallowed at a draught, sufficed him for a meal when nature's storehouse failed.

PINOLE.—All of our early chroniclers praised this parched meal as the most nourishing food known. In New England it went by the name of "nocake," a corruption of the Indian word *nookik*. William Wood, who, in 1634, wrote the first topographical account of the Massachusetts colony, says of nocake

that "It is Indian corn parched in the hot ashes, the ashes being sifted from it; it is afterwards beaten to powder and put into a long leatherne bag trussed at the Indian's backe like a knapsacke, out of which they take three spoonsful a day." Roger Williams, the founder of Rhode Island, said that a spoonful of nocake mixed with water made him "many a good meal." Roger did not affirm, however, that it made him a square meal, nor did he mention the size of his spoon.

In Virginia this preparation was known by another Indian name, "rockahominy" (which is not, as our dictionaries assume, a synonym for plain hominy, but a quite different thing). That most entertaining of our early woodcraftsmen, Colonel Byrd of Westover, who ran the dividing line between Virginia and North Carolina in 1728-29, speaks of it as follows:

"Rockahominy is nothing but Indian corn parched without burning, and reduced to Powder. The Fire drives out all the Watery Parts of the Corn, leaving the Strength of it behind, and this being very dry, becomes much lighter for carriage and less liable to be Spoilt by the Moist Air. Thus half a Dozen Pounds of this Sprightful Bread will sustain a Man for as many Months, provided he husband it well, and always spare it when he meets with Venison, which, as I said before, may be Safely eaten without any Bread at all. By what I have said, a Man needs not encumber himself with more than 8 or 10 Pounds of Provision, tho' he continue half a year in the Woods. These and his Gun will support him very well during the time, without the least danger of keeping one Single Fast."

The Moravian missionary Heckewelder, in his *History, Manners and Customs of the Indian Nations,* describes how the Lenni Lenape, or Delawares, prepared and used this emergency food:

"Their *Psindamóoan* or *Tassmanáne,* as they call it, is the most nourishing and durable food made out of the Indian corn. The blue sweetish kind is the grain which they prefer for that purpose. They parch it in clean hot ashes, until it bursts; it is then sifted

and cleaned, and pounded in a mortar into a kind of flour, and when they wish to make it very good, they mix some sugar [*i.e.*, maple sugar] with it. When wanted for use, they take about a tablespoonful of this flour in their mouths, then stooping to the river or brook, drink water to it. If, however, they have a cup or other small vessel at hand, they put the flour in it and mix it with water, in the proportion of one tablespoonful to a pint. At their camps they will put a small quantity in a kettle with water and let it boil down, and they will have a thick pottage. With this food the traveler and warrior will set out on long journeys and expeditions, and as a little of it will serve them for a day, they have not a heavy load of provisions to carry. Persons who are unacquainted with this diet ought to be careful not to take too much at a time, and not to suffer themselves to be tempted too far by its flavor; more than one or two spoonfuls, at most, at any one time or at one meal is dangerous; for it is apt to swell in the stomach or bowels, as when heated over a fire."

The best of our border hunters and warriors, such as Boone and Kenton and Crockett, relied a good deal upon this Indian dietary when starting on their long hunts, or when undertaking forced marches more formidable than any that regular troops could have withstood. So did Lewis and Clark on their ever-memorable expedition across the unknown West. Modern explorers who do their outfitting in London or New York, and who think it needful to command a small army of porters and gun-bearers when they go into savage lands, might do worse than read the simple annals of that trip by Lewis and Clark, if they care to learn what real pioneering was.

It is to be understood, of course, that the parched and pulverized maize was used mainly or solely as an emergency food, when no meat was to be had. Ordinarily the hunters of that day, white and red, when they were away from settlements or trading posts, lived on "meat straight," helped out with nuts, roots, wild salads, and berries. Thus did Boone, the greater part of two years, on his first expedition to Kentucky; and so did the trappers of

the far West in the days of Jim Bridger and Kit Carson.

Powdered parched corn is still the standby of native travelers in the wilds of Spanish America, and it is sometimes used by those hardy mountaineers, "our contemporary ancestors," in the Southern Appalachians. One of my camp-mates in the Great Smoky Mountains expressed to me his surprise that any one should be ignorant of so valuable a resource of the hunter's life. He claimed that no other food was so "good for a man's wind" in mountain climbing.

In some parts of the South and West the pulverized parched corn is called "coal flour." The Indians of Louisiana gave it the name of *gofio*. In Mexico it is known as *pinole*. (Spanish pronunciation, *pee*-no-lay; English, pie-*no*-lee.)

Some years ago Mr. T. S. Van Dyke, author of *The Still Hunter* and other excellent works on field sports, published a very practical article on emergency rations in a weekly paper, from which, as it is now buried where few can consult it, I take the liberty of making the following quotation:

"*La oomida del desierto*, the food of the desert, or *pinole*, as it is generally called, knocks the hind sights off all American condensed foods. It is the only form in which you can carry an equal weight and bulk of nutriment on which alone one can, if necessary, live continuously for weeks, and even months, without any disorder of stomach or bowels. . . . The principle of *pinole* is very simple. If you should eat a breakfast of corn-meal mush alone, and start out for a hard tramp, you will feel hungry in an hour or two, though at the table the dewrinkling of your abdomen may have reached the hurting point. But if, instead of distending the meal so much with water and heat, you had simply mixed it in cold water and drunk it, you could have taken down three times the quantity in one-tenth of the time. You would not feel the difference at your waistband, but you would feel it mightily in your legs, especially if you have a heavy rifle on your back. It works a little on the principle of dried apples, though it is quite an improvement. There is no danger of explosion; it swells to suit the demand, and not too suddenly

Suppose, now, instead of raw corn-meal, we make

it not only drinkable but positively good. This is easily done by parching to a very light brown before grinding, and grinding just fine enough to mix so as to be drinkable, but not pasty, as flour would be. Good wheat is as good as corn, and perhaps better, while the mixture is very good. Common rolled oats browned in a pan in the oven and run through a spice mill is as good and easy to make it out of as anything. A coffee mill may do if it will set fine enough. Ten per cent. of popped corn ground in with it will improve the flavor so much that your children will get away with it all if you don't hide it. Wheat and corn are hard to grind, but the small Enterprise spice mill will do it. You may also mix some ground chocolate with it for flavor, which, with popped corn, makes it very fine . . . Indigestible? Your granny's nightcap! . . You must remember that it is "werry fillin' for the price," and go slow with it until you have found your coefficient. . . .

Now for the application. The Mexican rover of the desert will tie a small sack of *pinole* behind his saddle and start for a trip of several days. It is the lightest of food, and in the most portable shape, sandproof, bug and fly proof, and everything. Wherever he finds water he stirs a few ounces in a cup (I never weighed it, but four seem about enough at a time for an ordinary man), drinks it in five seconds, and is fed for five or six hours. If he has jerky, he chews that as he jogs along, but if he has not he will go through the longest trip and come out strong and well on *pinole* alone."—*Shooting and Fishing,* Vol. xx, p. 248.

When preparing pinole for mountaineering trips, I used to pulverize the parched corn in a hominy mortar, which is nothing but a three-foot cut off of a two-foot log, with a cavity chiseled out in the top, and a wooden pestle shod with iron. The hole is of smaller diameter at the bottom than at the top, so that each blow of the pestle throws most of the corn upward, and thus it is evenly powdered. Two heaping tablespoonfuls was the usual "sup," and, if I had nothing else, I took it frequently during the day. With a handful of raisins, or a chunk of sweet chocolate or maple sugar, it made a square meal.

But what is the actual food value of this Indian invention? I take the following figures from a bulletin of the Department of Agriculture on *Food Value of Corn and Corn Products,* by Dr. Charles D. Woods (Washington, 1907):

Kind of material	Protein %	Fat %	Carbo-hydrates %	Mineral matter %	Fuel value per pound Calories
Hominy, boiled....	2.2	0.2	17.8	0.5	380
Hulled corn	2.3	0.9	22.2	0.5	490
Indian pudding (corn mush)	5.5	4.8	27.5	1.5	815
Hoecake	4.0	0.6	40.2	2.4	885
Boston brown bread	6.3	2.1	45.8	1.9	1,110
Johnnycake	7.8	2.2	57.7	2.9	1,385
Granulated cornmeal	9.2	1.9	75.4	1.0	1,655
Corn br'kfast foods, flaked (part cook'd at factory)	9.6	1.1	78.3	0.7	1,680
Corn br'kfast foods, flaked and parched (ready to eat) ..	10.1	1.8	78.4	2.4	1,735
Popped corn	10.7	5.0	78.7	1.3	1,880
Parched corn	11.5	8.4	72.3	2.6	1,915
Wheat bread (for comparison)	9.2	1.3	53.1	1.1	1,205

The remaining percentages are water.

Pulverized parched corn owes its "carrying power" not only to its relatively high nutritive value, as shown in this table, but largely to the fact that, when drunk with water instead of cooked, it swells in the stomach and gives it a comfortable feeling of fullness. That this is not an imaginary gain will be shown later in this chapter.

JERKED VENISON.—The "jerky" referred to by Mr. Van Dyke is jerked meat, usually venison: that is to say, lean meat cut in strips and dried over a slow fire or in the sun. It is very different from our commercial dried beef, less salty, more nourishing and appetizing, and one can subsist comfortably on it for some time with no other foodstuff at all. The process of jerking venison is described in Vol. I (pp. 277-280).

PEMMICAN.—The staple commissary supply of arctic travelers, and of hunters and traders in the far Northwest, is pemmican. This is not so palatable as jerky, at least when carelessly prepared; but it contains more nutriment, in a given bulk, and is better suited for cold climates, on account of the fat mixed with it.

The old-time Hudson Bay pemmican was made from buffalo meat, in the following manner: first a sufficient number of bags, about 2 x 1½ feet, were made from the hides of old bulls that were unfit for robes. The lean meat was then cut into thin strips, as for jerky, and dried in the sun for two or three days, or over a fire, until it was hard and brittle. It was then pounded to a powder between two stones, or by a flail, on a sort of hide threshing-floor with the edges pegged up. The fat and marrow were then melted and mixed with the powdered lean meat to a paste; or, the bags were filled with the lean and then the fat was run in on top. After this the mass was well rammed down, and the bags were sewed up tight. No salt was used; but the pemmican thus prepared would keep sweet for years in the cool climate of the North. A piece as large as one's fist, when soaked and cooked, would make a meal for two men. When there was flour in the outfit, the usual allowance of pemmican was 1¼ to 1½ pounds a day per man, with one pound of flour added. This was for men performing the hardest labor, and whose appetites were enormous. Service berries were sometimes added. "Officers' pemmican" was made from buffalo humps and marrow.

Pemmican nowadays is made from beef. Bleasdell Cameron gives the following details: A beef dressing 698 pounds yields 47 pounds of first-class pemmican, 47 pounds of second-class pemmican, and 23 pounds of dried meat, including tongues, a total of 117 pounds, dried. The total nutritive strength is thus reduced in weight to one-sixth that of the fresh beef. Such pemmican, at the time he wrote, cost the Canadian government about forty

cents a pound, equivalent to six pounds of fresh beef.

Pemmican is sometimes eaten raw, sometimes boiled with flour into a thick soup or porridge called *robiboo;* or, mixed with flour and water and fried like sausage, it is known as *rascho.* The pemmican made nowadays for arctic expeditions is prepared from the round of beef cut into strips and kiln-dried until friable, then ground fine and mixed with beef suet, a little sugar, and a few currants. It is compressed into cakes, and then packed so as to exclude moisture. It can be bought ready-made in New York, but at an enormous price when sold in small quantity, and the tins add considerably to the weight. If one has home facilities he can make it himself. Leave out the sugar, which makes meat unpalatable to most men. The sugar item should be separate in the ration.

Desiccated meat is disagreeable, and not nearly so nutritious as pemmican, which is already concentrated as much as meat should be, and has the advantage of containing a liberal amount of fat.

ARMY EMERGENCY RATIONS.—In 1870 there was issued to every German soldier a queer, yellow, sausage-shaped contrivance that held within its paper wrapper what looked and felt like a short stick of dynamite. No, it was not a bomb nor a hand grenade. It was just a pound of compressed dry pea soup. This was guaranteed to support a man's strength for one day, without any other aliment whatever. The soldier was ordered to keep this roll of soup about him at all times, and never to use it until there was no other food to be had. The official name of the thing was erbswurst (pronounced *airbs-voorst*) which means pea sausage. Within a few months it became famous as the "iron ration" of the Germans in the Franco-Prussian war.

Our sportsmen over here are well acquainted with erbswurst, either in its original form or, at present, as an American "pea soup with bacon" done

up in cartons. For many it is the last call to supper when they have had no dinner and see slight prospect of breakfast. Besides, it is the lazy man's prop on rainy days, and the standby of inexperienced cooks.

Erbswurst is composed of pea meal mixed with a very little fat pork and some salt, so treated as to prevent decay, desiccated and compressed into rolls of various sizes. It is much the same thing as baked beans would be if they were dried and powdered, except that it tastes different and it contains much less fat. I understand that the original erbswurst, as prepared by its inventor, Grunberg, included a goodly proportion of fat; but the article of commerce that appeared later had so little of this valuable component (by analysis only 3.08%) that you could scarce detect it.

Nobody can spoil erbswurst in the cooking, unless he goes away and lets it burn. All you have to do is to start a quart of water boiling, tear off the cover from a quarter-pound roll of this "dynamite soup," crumble the stuff finely into the water with your fingers, and boil for fifteen or twenty minutes, stirring a few times to avoid lumps. Then let the mess cool, and go to it. You may make it thin as a soup or thick as a porridge, or fry it after mixing with a little water, granting you have grease to fry with.

It never spoils, never gets any "punkier" than it was at the beginning. The stick of erbswurst that you left undetected last year in the seventh pocket of your hunting coat will be just as good when you discover it again this year. Mice won't gnaw it; bugs can't get at it; moisture can't get into it. I have used rolls that had lain so long in damp places that they were all moldy outside, yet the food within was neither worse nor better than before.

A pound of erbswurst, costing from thirty-two to forty cents, is about all a man can eat in three meals straight. Cheap enough, and compact enough, God wot! However, this little boon has a string attached. Erbswurst tastes pretty good to a hungry man in the woods as a hot noonday snack, now and

then. It is not appetizing as a sole mainstay for supper on the same day. Next morning, supposing you have missed connections with camp, and have nothing but the rest of that erbswurst, you will down it amid storms and tempests of your own raising. And thenceforth, no matter what fleshpots you may fall upon, you will taste "dynamite soup" for a week.

In its native land, this iron ration lost its popularity and was thrown out of the German army. Over here, we benighted wights keep on using it, or its American similitude, in emergencies, simply because we know of no better substitute, or because it is the easiest thing of the kind to be found on the market. We all wish to discover a ready-made ration as light and compact as erbswurst, as incorruptible and cheap, but one that would be fairly savory at the second and third eating, and polite to our insides (which "dynamite soup" is not).

Now I am not about to offer a new invention, nor introduce some wonderful good grub that has lately arrived from abroad. Before the outbreak of the present war, I believe, every army had discarded all the emergency rations it had tried. And yet all of them were searching for a better one. Which goes to prove that a satisfactory thing of this sort is most desirable, but the hardest thing in the world for a commissariat to find. We wilderness prowlers join heartily in praying that somebody will find it; for we, too, like the soldiery, may be cut off from supplies, no telling when, and with the added dilemma, perhaps, of being lost and alone in the "big sticks."

So it is quite worth while to review the best that has been done along this line, show wherein the most promising experiments have failed, and restate the problem anew—then let fresh inventive genius tackle it. And a few suggestions may not be out of place.

Beginning again with erbswurst, as prototype of such foods; theoretically it is highly nutritious, though less fit for continuous use as a sole diet than

baked beans, even though the latter were desiccated, Practically it soon palls on the palate, upsets the stomach, and, like any other food composed almost wholly of legumes, causes flatulent dyspepsia or other disorders of the digestive tract.

The British army tried it, and Tommy Atkins let out a howl that reached from South Africa to London. The War Office replaced it with another German invention, Kopf's soup, which also had pea meal for its basis but had a higher content of fat (17.25%). This was superior in potential energy, but the after effects were similar to those of erbswurst. It was plain that an exclusive diet, if only for a day or two, of legumes and fat would soon put a man to the bad. England discarded the iron ration and placated Tommy with jam—a wise move, as we shall see.

In 1900 a new kind of emergency ration was introduced in our own army. This was made up of eight ounces of a meat-and-cereal powder, four ounces of sweet chocolate, and some salt and pepper; all put up in a tin can eight inches long and thin enough to slip easily into one's pocket. This pound of food was calculated to subsist a man in full strength and vigor for one day. Details of its preparation are here copied from official sources:

"The chocolate component consists of equal weights of pure chocolate and pure sugar molded into cakes of one and one-third ounces each. Three of these go into the day's ration.

"The bread and meat component consists of:

"(1) Fresh lean beef free from visible fat and sinew, ground in a meat grinder and desiccated so as to contain five per cent or less of moisture, the heat never being allowed to cook it in the slightest degree. The dried product is then reduced to powder and carefully sifted through a fine-meshed sieve, the resulting flour being the meat component.

"(2) Cooked kiln-dried wheat, the outer bran removed, is parched and then ground to a coarse powder. This yields the bread component. Sixteen

parts of the meat, thirty-two parts of the bread, and one part of common salt, all by weight, are thoroughly mixed in such small quantities as to be entirely homogeneous and compressed into four-ounce cakes. Three of these go into the day's ration. The bread and meat may be eaten dry, or be stirred in cold water and eaten; or one cake may be boiled for five minutes in three pints of water, and seasoned [as soup]; or one cake may be boiled for five minutes in one pint of water to make a thick porridge and be eaten hot or cold. When cold it may be sliced, and, if fat is available, may be fried. Three-fourths of an ounce of salt and one gramme of pepper are in the can for seasoning."

At first glance it might seem that the bread and meat components of this ration were essentially the same as the pinole and jerked venison of our Indians and white frontiersmen—and it is quite likely that the inventors had those primitive foods in mind, seeking only to condense them still further without impairing their famous nutritive values. Practically, however, there is little resemblance. Jerky retains much of the meat juice, which gives it its pleasant flavor. Desiccated meat contains no juice, and its taste is altogether different. Pulverized, parched wheat is a sort of pinole, but in this case it was first cooked, then parched, and the flavor was inferior.

Finally the meat powder and grain powder were mixed and sifted into a homogeneous mass, compressed, and sealed up in an air-tight tin. One need not even taste such a product to know that it could not possibly satisfy the palate like the old-time preparations.

The emergency ration gave satisfaction for a time, but eventually there were many complaints that it was indigestible, or otherwise unwholesome. Scientists reported that it was lacking in nutrition. The troops did not like its taste, and their officers warned them to husband their hard bread and bacon as long as they could, since a very limited amount of either

or both, taken with the emergency ration, made it far more palatable. Another fault of this "near-food" was that the can that held it was so thick and heavy that it made the gross weight of the article almost as great as that of the regular haversack ration, which cost much less and had a better taste.

In 1913 the Secretary of War ordered the discontinuance of this emergency ration, notwithstanding that great quantities of it still were in storage. The problem of getting up a better one was turned over to food experts of the Department of Agriculture. About a year later a new emergency ration was, I believe, adopted, composed of bean flour, lean meat, raisins, and a small percentage of wheat flour. This is said to be palatable and nutritious, but I do not know how well it may have stood the test of service.

THE PROBLEM of an emergency ration is not merely one of condensing the utmost nutriment into the least bulk and weight. One cannot live on butter or peanuts alone, however high their caloric value may be. The stuff must be digestible: it must neither nauseate nor clog the system. When a man is faint from hunger (and that is the only time he ever will need an emergency ration) his stomach must not be forced to any uncommon stunts. And so I hold that a half ration of palatable food that is readily assimilated does more good than a full quota of stuff that taxes a man's gastric strength or disorders his bowels. And there is a good deal to be said for mere palatability. Food that tastes bad *is* bad, for nobody can work well on it.

Of course, an emergency ration is not intended to be used long at a time. It is not meant to interchange with the regular reserve ration of hard bread, bacon, or preserved meat, dried vegetables, coffee, sugar, and salt, that soldiers carry on their persons during a campaign. The iron ration proper is a minimum bulk and weight of unspoilable food that is complete in itself, packed in a waterproof and insect-proof cover, and it is never to be opened save

in extremity when reserve rations have run out and supply trains cannot connect with the troops. Yet this is the very time when men are likely to be exhausted and famished. It is the very time when their systems demand food that tastes good and that assimilates easily.

Again, an emergency ration should contain some component that digests rather slowly, or it soon will leave a feeling of emptiness in the stomach—it will not "stick to the ribs" like one that takes several hours to become assimilated. Moreover, the stomach craves bulk as well as nutriment—there should be something to swell up and distend it. This is important, for, if condensation be carried too far, it defeats its own purpose. If we could concentrate a thousand calories of food energy into a single tablet, a man would not feel that he had eaten anything after taking it.

Bread Substitutes.—The main difficulty in compounding a good emergency ration is in getting a concentrated substitute for bread. The Germans have experimented with flour or grits made from peanuts. It is claimed that a pound of peanut flour contains as much nutritive material as three pounds of beef or two of peas. It can be made into porridge or into biscuits. Its flavor is pleasant in either a cooked or a raw state. Whether its nutrients are easily and completely utilized by the system has not, so far as I know, been proven.

As for meal made from beans or peas, it is not easily digested, and it tends to putrify in the alimentary canal. (A method of desiccating baked beans is given in Vol. I, p. 368).

Hardtack may be considered a proper component of an emergency ration, because it is a concentrated bread that does not spoil. The best way to use it, when facilities permit, is to break it up and add it to hot soup or coffee, or pour hot water over it, pepper and salt, and eat with bacon grease.

Plasmon biscuit (see Vol. I., p. 192) are more palatable than hardtack and more nutritious, but

expensive. In appearance they resemble round Educator crackers. Half a dozen of them, with a small cake of chocolate, make a satisfying lunch. Plasmon itself is the proteid of milk in powdered form, containing 80% of pure protein. It may be used either dry or dissolved in water. When sprinkled dry over any kind of food, or cooked in with cereals, bread, soups, etc., it adds very much to the nutritive value without altering the flavor of the food.

Various kinds of meat biscuits have been tried out most thoroughly by troops and travelers, but without satisfaction. Kipling said, "compressed vegetables and meat biscuits may be nourishing, but what Tommy Atkins needs is bulk in his inside." In this he was doing the vegetables injustice, for, when cooked, they do swell up and fill one's inside.

Condensed Soups.—Nearly all go-light outfits include a supply of compressed soups. Some of these are of good flavor, others are of what Stewart Edward White calls the "dishwater brand." He recommends Knorr's pea, bean, lentil, rice, onion (none of the others), and particularly Maggi's green pea and lentil. Of bouillon capsules he says that "they serve to flavor hot water, and that is about all." I agree with him throughout. Maggi's soups are packed in tin-foil before putting on the paper wrapper. This excludes moisture, but I have found that it will not keep out the industrious weevil. Condensed soups have their uses, chiefly as pick-me-ups; but they do not by any means contain enough nourishment to furnish a hungry man's meal. I mention them here only as a warning against putting confidence in them for any such purpose.

Bouillon cubes, etc., are much worse, in this respect. Properly they are nothing but condiments or appetizers for healthy people and mild stimulants for the sick. Their actual food value has been determined by the Bureau of Chemistry of the U. S. Department of Agriculture, which was led to investigate the matter because "these articles are erroneously believed to be convenient forms of concentrated meat."

Ten different brands of commercial bouillon cubes were analyzed, with the result that the best showed 62% salt, 5.25% water and fat, 28% meat extract, 4.75% plant extract, and from this they ranged on down to the poorest, with 72% salt, 8.5% water and fat, 8.17% meat extract, 11.33% plant extract. The plant extract " is useful because of its flavoring properties, but has slight, if any, nutritive value." As for the semi-solid meat extracts sold in jars, the chemist reported that they "are not concentrated beef. They are stimulants and flavoring adjuncts, and have only a slight food value, owing to the small amount of protein (muscle-building food) which they contain."

On the other hand, one can make for himself a real meat extract, in which much of the nourishment of beef or veal or venison is concentrated in the form of little cubes of a gluey consistency from which a strengthening soup can quickly be prepared.

Take a leg of young beef, veal, or venison (old meat will not jelly easily). Pare off every bit of fat and place the lean meat in a large pot. Boil it steadily and gently for seven or eight hours, until the meat is reduced to rags, skimming off, from time to time, the grease that arises. Then pour this strong broth into a large, wide stew-pan, place it over a moderate fire, and let it simmer gently until it comes to a thick jelly. When it gets so thick that there may be danger of scorching it, place the vessel over boiling water, and stir it very frequently until, when cold, it will have the consistency of glue. Cut this substance into small cubes and lay them singly where they can become thoroughly dry. Or, if you prefer, run the jelly into sausage skins and tie up the ends. A cube or thick slice of this glaze, dissolved in hot water, makes an excellent soup. A small piece allowed to melt in one's mouth is strengthening on the march.

This is a very old recipe, being mentioned in Byrd's *History of the Dividing Line*, and recommended along with rockahominy. The above can be made in camp, when opportunity offers, thus laying

in enough concentrated soup stock to last a month, which is quite convenient, as it takes at least half a day to make good soup from the raw materials, and these are not always at hand when most wanted.

Fats.—In speaking of erbswurst I remarked on its deficiency in fat, which is an important component of field rations, especially in cold weather, since it is fuel for the body. Pemmican owes much of its efficiency to the large percentage of fat. Captain Scott had the pemmican for his antarctic expedition made with 50% lard, which is pure fat. Such a mixture would nauseate many a man, but nearly everybody likes butter, which is the next most concentrated form of fat. The best field luncheon for cold weather, when you can get it, is in the form of sandwiches of toasted bread, thick slices of butter, and brown or maple sugar. It is very nourishing, and it will not freeze up like plain bread, as there is practically no water in it. Outfitters supply excellent butter, in one-pound cans, that will keep in any climate.

Butter is out of the question in an emergency ration that is to be sealed up and kept indefinitely. There are, however, certain other fats that will take its place as fuel.

Desiccated Eggs, if prepared from the whole egg, contain 36% of fat. They are also remarkably rich in protein. There is no good reason, except its cost and the fact that it requires cooking, why egg powder should not form a considerable constituent of an emergency ration, as it keeps perfectly when protected from moisture. (See Vol. I., pp. 183 and 189). Its fat content is nearly equal to that of full cream cheese, and its fuel value nearly a third more.

Chocolate, in plain form, contains about 49% of vegetable fat; less, of course, when sweetened. It is necessary, however, for eating purposes, that chocolate should have considerable sugar added, and this is directly a gain, for sugar itself is stored energy, as we soon shall see. Chocolate never gets stale.

It requires no cooking, can be eaten on the march, yet a stimulating hot drink can be prepared from it in a few minutes. It is the experience of Alpinists and other go-light artists that no other raw food of equal weight and bulk will carry a man so far under severe strain as a handful of raisins and a cake of chocolate. When eaten by itself, chocolate is constipating and cloying, at least to some people. Raisins eaten along with it prevent digestive troubles; a couple of crackers help the ration.

There is a "camper's emergency ration," carried in stock by outfitters, that contains chocolate, malted milk, egg albumen, casein, sugar, and cocoa butter, with added coffee flavor. Three cakes of it, each sufficient for a meal, are wrapped in paper and tinfoil and enclosed in a sealed box with key-opener, the box being 4½ x 3 x 1⅜ inches, and rounded for the pocket. The net weight of the ration is 8 ounces; gross weight of box filled, 11½ ounces. Chocolate is not to be recommended for hot weather.

NUTS.—The table of food values in Vol. I., pp. 182-184, shows that various nuts are very rich in vegetable fat, and so have high fuel values. They are discussed on page 196 of the same volume. Nuts should be chewed thoroughly, so as to be well mixed with saliva, or they will clog the digestive tract.

SWEETS.—Sugar has peculiar merit as a component of the emergency ration. All old-timers know from experience that one has an unusual craving for sweets when working hard afield. Hunters and lumberjacks and soldiers suffered from that craving long before scientists discovered the cause of it, which is that during hard muscular exertion the consumption of sugar in the body increases fourfold.

It may sound odd but it is true, that when hunters or explorers are reduced to a diet of meat "straight" the most grateful addition that they could have would be something sweet. Men can get along very well on venison, without bread, if they have maple sugar or candy and some citric acid (crystal-

lized lemon juice) to go with it. And there is good reason for this. Sugars have about the same food uses as starches, because all starch must be converted into sugar or dextrin before it can be assimilated. Mark, then, that sugar needs no conversion; therefore it acts quickly as a pick-me-up to relieve fatigue, while bread or any other starchy food would have to go first through the process of changing into sugar before it could supply force and heat to the body.

A great advantage of sweets is that every normal person likes them. Another is that they are antiseptic and preservative, which adapts them perfectly to use in rations that may have to be stored or carried a long time before using.

These are not merely my own individual opinions, although all my experience backs them. Since the worth of sweets in a sportsman's or soldier's food supply is commonly underrated, or even ridiculed, through sheer crass ignorance, let me quote from Thompson, one of the most eminent of our dieticians:

"The value of sweets in the adult dietary has of late years found recognition in armies. The British War Office shipped 1,500,000 pounds of jam to South Africa as a four months' supply for 116,000 troops, and one New York firm, during the Spanish-American War, shipped over fifty tons of confectionery to the troops in Cuba, Porto Rico, and the Philippines. The confectionery consisted of chocolate creams, cocoanut macaroons, lemon and other acid fruit drops. . . .

"An old-time custom among soldiers in the field is to fill a canteen with two parts vinegar and one part molasses as an emergency sustaining drink. . . .

"Sugar furnishes, in addition to heat, considerable muscle energy, and it has been lately proved by Mosso, Vaughn Harley and others to have distinct power in relieving muscular fatigue.

"Vaughn Harley found that with an exclusive diet of 17½ ounces of sugar dissolved in water he could perform almost as much muscular work as upon a full mixed diet. The effect in lessening muscle fatigue was noticeable in half an hour and reached a maximum in two hours. Three or four ounces of

sugar taken before the expected onset of fatigue postponed or entirely inhibited the sensation.

"The hard-working lumbermen of Canada and Maine eat a very large quantity of sugar in the form of molasses. I have seen them add it to tea and to almost everything they cook. Sugar has also been found of much service upon polar expeditions."

Many of our sportsmen, when going light, substitute saccharin (saxin, crystallose) for sugar, thinking thereby to save weight and bulk. This is a grave error. It is true that saccharin has enormous sweetening power, and that moderate use of it on an outing trip, in one's tea and coffee, will do no harm. But the point overlooked is that sugar is a concentrated source of energy, easily and quickly assimilated, whereas saccharin produces no energy at all, being nothing but a coal-tar drug. It is the grape sugar in raisins, for example, that makes them so stimulating.

Sir Ernest Shackleton, in outfitting his party for their recent antarctic expedition, made sugar figure largely in the rations. On the previous exploring trip he and his companions each took two or three lumps of sugar every two or three hours, and he said that ten minutes after eating it they could feel the heat going through their bodies.

One at least of the nations engaged in the present war supplies its men in the trenches with a daily ration of ten ounces of sugar, which is over three times the allowance of sugar in the field ration of our own service. "It has been found, however," says *Outing,* "that this abundance of sweet not only gives the soldier added muscular strength but increases his resistance to cold and fatigue, both physical and nervous. The action of sugar is most effective when dissolved in some hot liquid: it is especially beneficial taken in chocolate."

FRUITS.—One fault of all the ready-made concentrated rations that I have seen was that they contained no acids. A fruit acid is needed, even in a food preparation that is to be used only for a day or two, in order to correct the ultra-sweet or fatty

components, and is particularly desirable in summer. It is easy to supply the deficiency, in very concentrated form, by adding tablets of citric acid. This makes refreshing lemonade. Lime-juice tablets are good on the march, as they combine sugar with acid, and not only supply energy but ward off thirst. Fruit acid is supplied in very palatable form by dehydrated rhubarb and cranberries, which cook in a few minutes, and can scarcely be told from the fresh articles.

Raisins have already been mentioned several times. Their stimulating effect, due to the grape sugar in them, is felt ten minutes after eating. On the trail, when working hard, as in mountain climbing, it is a good rule to eat little and often. Raisins are particularly convenient for munching as one goes along. They have added value in that they are mildly laxative, and something of that sort is certainly needed in the ration. Figs have the same virtue. I imagine the seeds have something to do with this, and for that reason I do not use seedless or seeded raisins.

Dehydrated vegetables have no place in emergency rations simply because they require long cooking.

Ration Packing.—The mere weight of the tin container of the discarded U. S. A. emergency ration was a serious objection. Such a box will weigh about a third as much as the food itself. Being made of heavy tin, it is hard to open. If a key opener is attached, it is likely to be lost. A cover of parchment paper, which is waterproof, dirt-proof, and insect-proof, like the erbswurst "sausage," is cheaper, easier to apply, weighs practically nothing, and can be torn off with the fingers.

I think it is a mistake to mix meat powder with legumes or cereals and seal the mass up in an airtight cover. In such case, each food taints the other. The combination has a stale, nondescript taste, whereas each component would preserve its natural flavor if packed separately. For woodsmen, if not for troops, it seems more practical to put up

the emergency ration in two, or even three, separate packages, each containing only such articles as will not taint nor steal flavor from the others. This suggestion is made for rations to be carried in stock by outfitters, which are likely to be kept a good while in storage.

But when a camper puts up emergency grub for himself, there is a better way. Raisins, pinole, and the like, are best carried in little bags of thin paraffined cloth (the "balloon silk" of tent makers), tied low enough so that the top can be doubled over and tied again, making a water-tight package, very light, and soft enough to go into one's pocket, or anywhere. Chocolate (which I don't carry in hot weather) usually comes wrapped in tin-foil, and enclosed in paper. You will need salt, in a waterproof bag or a bamboo tube, to season such game or fish as you may get.

If you carry anything in which water can be boiled, put a dozen tabloids of tea in the ration, leave out chocolate and substitute sugar. A hot cup of sweetened tea is one of the best hearteners that I know of, and the tabloid tea sold by outfitters is pretty good. But what vessel to boil in? Water can be boiled in a bark cup, as I shall show hereafter; but maybe you can't find bark that will peel. A practical outdoorsman, C. L. Gilman, suggests that the emergency food be packed in a half-pound cocoa can, which is of handy shape for the pocket, seamed water-tight without solder, holds a pint, and has a cover that fits over the outside. Punch two holes near top edge of can, and make a removable wire bail that will stow inside. Steam escapes through bail holes when cover is on. Thus your grub has a light tin container that is good for something when it is opened.

For myself, I would fill that little kettle with pinole, sugar, tea, and salt, in "pokes," and would carry some raisins separately. One advantage of pinole, aside from those already mentioned, is that it is not, like chocolate and raisins, a confection

that tempts one to draw on it when he does not need it, albeit the flavor is good, when the stuff is properly prepared, and does not pall on the appetite.

LIGHT TRAVELING RATIONS.—Many correspondents have asked me to suggest a "grub list" for men traveling light—one that should be complete in itself, without helping out by game or fish or articles purchased on the way. Tastes differ, and "what is one man's meat is another man's poison." Some assimilate their food more completely than others. I know of several experienced campers who seem to get along very well on a food allowance (their own choice) of from 1½ to 1¾ pounds a day. They are quite exceptional. An average man, engaged in hearty outdoor exercise, requires, on a trip of more than two or three days, about 2¼ pounds a day of carefully selected and varied food that is, as nearly as practicable, water-free. Study the chapter on PROVISIONS in the first volume of this book, paying heed to the table of nutritive values.

As all-around advice, I can do no better than suggest, for a real light but adequate and wholesome ration, what I have given on the list of Summer Equipment for Back-packing in Chapter VII., omitting the cheese. This would make the ration 2 lbs. 3 oz. *net*. The tea (not tabloids) and salt are purposely in excess of what a man would likely consume. Admiral Peary's ration for arctic sledge journeys (2 lbs. 4¼ oz.) given in Vol. I., p. 190, may be regarded as a minimum for hard work in winter. It is a monotonous diet, deficient in sugar and in fruit acid, although his pemmican contained a little of both.

CHAPTER XI

MARKSMANSHIP IN THE WOODS

Never shall I forget the remark that a backwoodsman once made when I was trying to entertain him at a rifle match near St. Louis. I had shown him the shooting-house, the target-house, and their appurtenances; had explained our system of scoring and our code of rules; had told him the reasons for using such heavy rifles, sensitive triggers, pronged butt-plates, cheek-pieces, vernier and wind-gauge sights—all that; and then I bade him watch some of our experts as they made bullseye after bullseye, seldom missing a space the size of a man's head, shooting offhand, at 200 measured yards. I thought that my friend would be impressed. He was; but not quite as I had anticipated. After watching the firing for a long time in silence, he turned to me and remarked: "If it weren't for the noise and the powder smoke, this would be a very ladylike game."

Of course, I was piqued at this, and felt like giving the honest fellow a peppery reply. And yet, many a time since, as I have sat, chilled to the bone, on some crossing in the high Smokies, straining my ears for the bear-dogs far below; or, tired beyond speech and faint from hunger, as I lay down beside a log in the great forest, all alone; or, blown by hard climbing till my heart seemed bursting, as I wiped the mist from my eyes, and got down on all fours to follow a fresh spoor into the hideous laurel fastness of Godforsaken—aye, many a time I have looked backward and thought, "You were right, partner; it was a very ladylike game."

It was a long time ago—that shooting match. If

a city man, in those days, wanted to practice with a rifle at targets, he had to join a "schuetzen" society. (In Missouri the organized militia had no range, and never fired a rifle except with blanks!) So we had to fall back on a foreign system that never yet has found so much as an English name. The schuetzen method did teach a man to hold steadily and to let off delicately, and this is the A B C of marksmanship. But it stopped there. It taught the A B C forward and backward till the pupil became, perhaps, wonderfully expert in such exercise; but it never got beyond A B C and Z Y X. It taught him to drive a nail with a bullet, offhand; but nothing about quick firing with accuracy, nothing about hitting moving objects, nothing about judging distances and making true allowance for them, nothing about aiming at a neutral-colored object that blended with its surroundings. Our men were "crackajacks" at drilling a squirrel's head, but only the few who took regular hunting trips in the wilderness had any idea of what kind of a thing to look for if they went after deer or any other big game.

Rifle Practice.—Times have changed. Civilians now can join clubs that have the use of military ranges, where they can use practical weapons supplied by the Government, at known and unknown distances, deliberate fire and quick fire, resting at ease or after a skirmish run. They may, if they choose, rig up "running deer" targets. All this is excellent practice for one preparing to go after big game.

If you are so situated that you cannot join such a club, nor use a powerful rifle in your neighborhood, get a repeating .22, learn first to drive tacks with it (in a city basement, if need be), then take it out somewhere that is safe for the purpose, and shoot at miscellaneous objects, at unknown distances all the way from twenty to a hundred yards. If you can get a friend to roll a barrel for you down a bumpy hillside, try it at various angles—good training before you go to shoot at deer on the bound.

It is practice, intelligently varied practice, that

makes a marksman. Without it, the keenest eye and the steadiest nerve are of no avail. I have associated intimately with expert riflemen for half a lifetime, and I know that every one of them would tell you that there "is no such animal" as a born marksman. There never was. If frontiersmen generally are good shots it is simply because they have had plenty of practice from their youth up. Some have natural advantages over others, to be sure, but nothing will take the place of training. It is like writing, for instance: anybody of average sense can learn to write correctly, many can write entertainingly, a few have genius and may become immortal—but no genius who ever lived has turned out first-class work at the first trial: he had to practice, practice, practice!

There is no room here to discuss the topic of hunting rifles. Get the best that you can, of course; but do not worship it. Bear in mind that, whatever its trajectory and smashing quality, it is only a gun, and can kill nothing that you miss with it. When you get into the real wilderness far away from rich men's preserves and summer hotels, you will find there some mighty hunters who make mighty kills with guns that would bring only the price of scrap-iron in New York.

Get sights that you can *see,* and such as you are not likely to overshoot with when taking quick aim. Take pains to get what suits your eyes, and spare no time in the adjustment. Never take an untried gun into the woods. That is no place to align sights and test elevations. Never trust the sights as they are placed on the gun at the factory. Test them not only from rest, but offhand, too; for a light rifle charged with high-power ammunition is likely to shoot several inches higher (or in some other direction) when fired from muzzle-and-elbow rest, than it does when shot offhand, albeit it may be an accurate weapon when rightly used.

SIGHT ADJUSTMENT.—Now, as for adjusting the elevation—a most important matter—first, by all means, find the "point-blank" of your weapon by actual test. If your dealer assures you that a cer-

tain rifle shoots practically point-blank up to 300 yards, "trust him not; he's fooling thee." Theoretically there is no such thing as a point-blank range. Practically, what we mean by it is the extreme distance to which a rifle may be sighted to strike center without overshooting at any intermediate distance the vitals of the animal to be hunted.

Why a bullet rises above the line of aim and stays above it until it reaches a point for which the sights were set, and then falls below it, if not stopped; how much it does so, at various ranges and with various types of ammunition; how to determine the best point-blank for different kinds of hunting: these are matters that would require a good many pages to explain. (See the writer's *Sporting Firearms,* in the series of "Outing Handbooks").

In the big-game fields of the East and South, which generally are thickly timbered or bushy cut-over lands, it is seldom that one gets a shot at over 60 or 70 yards, unless he is in the mountains or on the margin of a lake or river. Even an old-fashioned rifle, using ammunition of, say 1,300 feet muzzle velocity per second, if sighted accurately for 50 yards, will not drop its bullet more than two inches at 75 yards, and at 25 yards you need only draw a wee bit fine to cut off the head of a grouse or squirrel. Fifty yards, then, is a good elevation at which to set the rear sight of such a gun. A .30-30, or other rifle of the 2,000 feet M. V. class, shoots to this same "practical point-blank" up to 100 yards when sighted for 75 yards.

In other words, the hunter need make no allowance for distance, in aiming, up to these respective ranges, except when shooting at small game close by. This is why so many old hunters east of the Mississippi take little or no interest in guns more powerful than the kinds here mentioned. They don't feel the need of anything better. If they should unexpectedly have to take a long shot, and do it quickly, they simply draw a coarse bead, or hold high, and take their chances.

In the West it is different. Much of the game country is open. Often you can't get close by stalking. Shots at 200 yards are common, and much longer ones can be made successfully by a well-trained marksman armed with a very *accurate* rifle that drives its bullet at a high and *well-sustained* velocity. I emphasize the words "accurate" and "well-sustained" because there are many rifles that are inaccurate beyond 100 or 150 yards, and that start their bullets swiftly but do not maintain a high velocity beyond short range. Their trajectory figures are illusory, because trajectory means only the *average* or mean height of bullet flight above line of fire at such and such intermediate distances. Take, for example, a .30-30 sighted for 200 yards. Its trajectory at 100 yards is given in the tables as 5.79 inches above line of fire; but, as a matter of fact, the shots vary so much at 100 yards that they may go anywhere from 3.40 to 8.40 inches high; at 250 yards, with same aim, they may drop anywhere from 2.25 to 14.75 inches below line of fire. Yet the .30-30 is considered a fairly accurate cartridge: there are others, with short, snub-nosed bullets, that shoot much worse.

Now, by contrast, let us consider a gun that shoots swift and true at all ranges, for instance one using our Springfield ammunition. I take the liberty of quoting from Captain Whelen the following table of such a rifle's actual performance, with 150-grain bullet, when sighted for 200 yards, and some of his comments thereon:

Trajectory	Range in Yards			
	100	200	225	300
Above line of fire, in. ...	2.5	0	....	....
Below line of fire, in.		0	1.9	9.
Sight allowance, in.	.5	0	.12	.5
Above line of *aim*, in....	2.	0	....	....
Below line of *aim*, in.		0	2.02	9.5
Mean vertical deviation, inches	.8	1.6	1.8	2.4
Greatest deviation from point of *aim*, with range unestimated, in. ..	2.8	1.6	3.82	11.9

"From this table, with the sights adjusted correctly for 200 yards and using the service ammunition, we can arrive at the following facts: Suppose one has not time to think of estimating the exact range, or has not the talent to do so. But he thinks his quarry is about 200 yards off. He fires. If the game was at 100 yards the greatest error he need expect is a hit 2.8 inches above the point aimed at. If the game was exactly at 200 yards then only the error of the rifle and ammunition need be counted on which is 1.6 inches either above or below. If again the game was at 225 yards the greatest deviation would be a hit 3.82 inches below the point aimed at. In other words, with the sights thus adjusted one would be sure to hit within the vital 8-inch disk at all ranges up to 225 yards, provided always of course that his sights were correctly aligned at the center of the disk at the instant of discharge. At no point during its flight, would the trajectory and the accuracy error, together, carry the bullet over three inches above the line of aim, and at 225 yards it would hit but 3.82 inches low. Should the range be over 225 yards, the visual angle subtended by the game, that is its appearance, will be so small that the hunter will not risk a snap shot but will instinctively proceed to take all those precautions necessary for a long range shot including a careful estimate of the range and wind direction and velocity and an accurate setting of the sights for those estimates.

"Thus, for all around work in hunting with the Springfield rifle, using the service cartridge, in order to attain the highest efficiency and the greatest chance for a properly placed hit, we should use three adjustments of the rear sight, as follows:

For small game at close range .... 40 yards
For apparently easy shots at large game 200 yards
For apparently hard, long shots at any
game ....The estimated range."

The "vital 8-inch disk" refers to an expression I used in the book *Guns, Ammunition, and Tackle*:

"Let us say that an 8-inch disk represents that part of a deer in which a bullet may be counted on to inflict a mortal wound; then the deer's killing zone would be that distance throughout which the trajectory of the bullet would cut an 8-inch disk. For open country, where long shots are the rule, the rifle may then be sighted for an extreme rise of 4 inches above line of *aim,* and the killing zone for deer will extend to that point where the descending bullet falls 4 inches below line of *aim.* Remember that line of aim or sight is different from line of fire (prolongation of axis of bore)." If the top of front sight stands one inch above axis of bore, then you subtract from the midway trajectory one-half inch, and make proportional allowances at other points intermediate or beyond the range sighted for. In all targeting to determine point-blank you must aim exactly *on* the point to be hit—not at lower edge of a bullseye, but at its center.

The old-fashioned practice of "drawing coarse" for a long shot is guesswork. A novice is almost sure to overdo it. An experienced hunter may do very well that way, so long as he uses rifle and ammunition that he is thoroughly familiar with; but let him change to something different and he must learn all over again. That is one reason why many expert hunters are old-fogyish about arms and ammunition. On the other hand, there is no guesswork in the system of determining a "practical point-blank" and then aiming straight at the spot you want to hit. It "gets the meat" with certainty—always provided, my brother, that you hold true and draw trigger without jerk or quiver.

It is not nearly so much the "make" of rifle as *the load it takes* that determines the gun's shooting qualities. So, choose first a cartridge, then a gun to handle it. For example, the Springfield cartridge is a good one for big game at all ranges; but you can use it in rifles of several different makes, and most of them will do the same work with it. The old .44-40 is still a good cartridge for brush-shooting at

deer, but a mighty poor one beyond 100 yards, no matter what kind of a rifle it is shot out of. And so we might go on through the whole maze of ammunition lists. But how to choose a cartridge? Well, here are two rules that will help a good deal:

(1) No cartridge is accurate beyond a very moderate distance unless the bullet is at least

3 calibers long for .25 caliber bullets,
2½ calibers long for .30 to .35 caliber bullets,
2 calibers long for .40 to .45 caliber bullets,
1¾ calibers long for .50 caliber bullets.

(2) No bullet is accurate at high speed unless it either is long and heavy or has fine lines forward, as one would say of a boat.

HUNTERS' MAXIMS.—This is not an essay on hunting, but in trying to give an idea of how marksmanship in the woods differs from marksmanship on the range, it may help a beginner to understand just what is meant if I first state certain maxims of the still-hunter's craft:

(1) Hunt one kind of animal at a time, and think of *it*.

(2) Know its strong points and its weak ones.

(3) Know where to hunt and where not to.

(4) Choose favorable ground.

(5) Consider the animal's daily habits.

(6) Know just what to look for.

(7) Maneuver according to a definite plan.

(8) Work against the wind, or across it.

(9) Move noiselessly and reconnoiter carefully.

(10) Try to see the game before it sees you.

(11) Keep cool.

(12) Never fire at anything until you are absolutely *certain* it is not a human being.

(13) Never fire a shot that is not the best you can possibly do.

(14) After firing, reload instantly.

(15) If you wound an animal, don't follow immediately upon its track, unless you are sure it is shot through the heart.

(16) Be patient over ill-luck, and keep on trying.

Serve your apprenticeship under a guide. He can teach you more in a week than you could learn by yourself in a year. There are, however, two books that every beginner ought to study before he goes to the woods: Van Dyke's *Still Hunter* and Brunner's *Tracks and Tracking,* both of them far and away ahead of anything else on their respective subjects. Don't try to memorize, but read and re-read until the lessons have soaked in. They will make it much easier for you to understand your guide's movements and directions (but don't quote your book-learning to him, or to anybody else).

After you have learned something of woodcraft by actual experience in company, make a practice of going alone and putting it to the proof. In still-hunting, two men working together make four times as much noise as one would by himself. They more than double the risk of alarming the game by their scent, as they seldom will be right together. And each relies too much on the other. "Tom may jump one to me" is a thought that has spoiled many a hunt (and hunter). You don't want any Tom to think about: you want to think *deer,* if that is what you are after.

WHAT TO LOOK FOR.—Wild animals in the woods do not look at all like the same species do in captivity or in picture-books. Only at rare intervals does one see a buck in the open posed like Landseer's "Stag at Bay," and when he does, the picture is altogether different. The buck's coloration blends with his surroundings. You never see him in stark relief unless he be on a ridge, outlined against the sky, or somewhere with a broad sheet of water for a background. Nor does he carry his head erect, unless suspicious, startled, challenging, or browsing on branches that hang above him.

A deer is always hard to see unless he be out in the open, or in the water, or on the jump. Generally its body is half hidden, or more than half, by underbrush or intervening trees. So what you want to look for is not an animal as a whole, but for *spots* of

leaden gray (the "blue" coat of autumn and winter) of no particular shape. The spot may seem fairly vaporous, like fog. Of course if the animal moves, you will see it, but probably not until it is sneaking stealthily but swiftly away. Then there are trees in the way, and brush; your footing may not be secure; the light may be shining in your eyes; and, with it all, you must shoot quickly, or lose the opportunity. Under such circumstances it is absurdly easy to miss a full-grown deer at twenty paces. So *try* to see the game before it sees you. Quite likely you won't; but if you have maneuvered against the wind so that the animal has not caught your scent, it may stay quietly hidden, trusting in the cover of the shrubs, or it may hesitate long enough for you to raise your gun before it moves.

Running Shots.—A deer does not gallop unless a dog is after it. When fleeing from a man it commonly goes at an indescribably easy and graceful lope, varied at every few bounds by a high, long leap. It does not seem to be exerting itself, yet it goes pretty fast. Having got out of the immediate neighborhood, it subsides into a trot or amble, and then stops, looks backward, and scents the air, to find if it is pursued.

Now a deer on the jump is hard to hit. The points to be observed are: To be as alert at all times as though you were hunting grouse without a dog; to get your gun in position the instant that you see the game; to pick out, as quick as lightning, a clear space through which to fire; but, *above all things,* not to shoot until you are absolutely certain that it is game you are shooting at; and then to dwell on the aim just long enough to see your bead clearly and to hold for a vital spot. Beyond that, do not hesitate the fraction of a second. To give a novice an idea, I would say that three or four seconds is a fair average interval between raising the rifle and firing, when a deer has been jumped in the forest. It is not so much the hands, but the eyes and brain, that must be quick, very quick.

When a deer is running in the open, follow it with the rifle about as you would a bird with a shotgun, only don't "lead," that is, consciously. At a hundred yards, a high-velocity bullet will reach him in the time that it takes him to go, say, four feet. If your rifle is swinging with him, you don't have to hold ahead. And most shots at running deer are at a shorter distance than that. Try to catch him as he strikes the ground at the end of a jump. Anyway, beware of firing too high. Most of the time he is "hugging the ground" pretty close.

In thick timber, don't try to swing with him—you can't see him well enough. Pick out an opening that he will cross, and fire the instant his head crosses above your front sight (this is a general idea —"lead," in this case, depends on distance). Then you will, at least, not send your bullet *whack* into an intervening tree.

Although one may often get a chance for a standing shot, yet I think it is best to spend most of one's target ammunition (at home) in snap-shooting. By snap-shooting with the rifle I do not mean merely glancing along a barrel and disregarding the sights. You must see your bead, and, in case of open sights, you must see that the bead is well down in the notch; but it is snap-shooting to press the trigger instantly when it first touches, or rather when it swings close to, the object that you want to hit, instead of waiting to swing back and steady down, as one would do when aiming deliberately. To snap-shoot at the right instant, without pulling off to one side, is a fine art.

The main trouble, in such cases, is to select the right spot to shoot at, and then to find it over the sights. With a deer, for example, the color is so neutral and the outlines are so indistinct, even in good light, that a man's eyes can seldom distinguish the exact spot that he wants to hit. He judges where it must be, from the general bulk of the animal and the position in which it is presented.

WHERE TO AIM.—Standing shots, even at a con-

siderable distance, call for no comment, as they are comparatively easy, in good light, for anyone who has been well trained on the rifle range at home—provided he does not get "buck ague."

For a broadside shot, the best point to aim at is immediately behind the shoulder and only one-third of the way up from breast to withers—that is, where the heart lies. When the body is presented in any other position, shoot, as a rule, at such a point that the bullet, in ranging forward, will pass through or close to the heart. When an animal stands looking at me as a deer often will when it comes in on a runway and one bleats or whistles at it, my favorite shot is the neck. A bullet passing through any animal's neck, near the center, is almost sure to strike a paralyzing, knock-out blow, because it can scarcely miss a vital part.

Aim low when shooting downhill, because then you see more of the upper side of the animal than you ordinarily would. A shot high up is seldom fatal, unless you hit the spine. In making long shots downhill, do not forget that the only distance to be allowed for is that from the mark to a point directly *under* you and *level with the mark.*

Aim dead-on when shooting uphill, unless the range is greater than your rifle is sighted for on a level. The extra allowance for "lift" is so trifling at ordinary ranges that you had better disregard it than overdo the matter.

Don't rely on "raining lead." The man who does his "darndest" with the first shot is the one who gets most venison in the long run. But reload instantly, and be ready, if necessary, to follow up without hesitation. Shoot until the animal is down, or while it remains in view.

If a deer is not hit, it goes off with its "flag" (white underside of tail) in the air. If hit, it may or may not clap its tail down. When struck in the rear half of the body (unless through the spine, which is a knock-out) it will likely kick out its hind legs, and there is some long trailing ahead of you.

Even when shot through the heart, a deer may run a hundred yards or more; but when it drops it is dead. If you are sure that it was a heart shot, follow up at once, but if you are not, then wait a good while. A wounded deer, when it finds it is not followed, is likely to lie down; then it gets stiff and weak from loss of blood. Give it time for this before you go after it. Don't follow directly on its tracks, for it will watch backward as long as it can hold its head up, and will run again, if possible, the instant it finds itself followed. Go in half-circles, to one side, then in to the trail, out again, and so on, until you have headed it on the leeward side.

Buck Fever.—History mercifully does not record how many thousand big and bewhiskered armed men, at their first sight of big game, have stood or sat with mouth wide open, gazing at the thing, oblivious to everything else on earth, including the loaded gun in the hand. If a deer only could wink one eye!

Buck ague is different. With it, the victim knows it is a deer before him, and knows but too well that he has a gun. But he also has as bad a case of "shakes" as a toper after a long spree. This affliction may overcome a rifleman in any kind of hunting, but it is most likely to seize upon the novice when he is sitting on a stand and hears the dogs baying toward him. It is hard on a fellow's nerves to sit there, praying with all his soul that the bear may not run some other way, and yet half doubtful of his own ability to head it off if it does come his way. The chances are that it will by no means run over him, but that it will come crashing through the brush at some point on one side, toward which he will have to run with all his might and main before firing. Now if he does let that bear go through, after all the hard work of dogs and drivers, his shirt-tail will be amputated that night by his comrades and hung from a high pole in the midst of the camp—a flag of distress indeed! Who wouldn't get buck ague in the face of such alternative?

It is hard on a fellow's nerves, I say, to hear those dogs coming toward him, and to know from the racket that a bear is certainly ahead of them, but *not* to know where or when the brute may emerge, nor what infernal trees or thickets and downwood may be in the way. Can you hit him? That is the question. The honor of the camp is on your shoulders. Ah, me! it is easy to follow the pack on horseback—to chase after something that is running away. But to sit here clenching your teeth while at any moment a hard-pressed and angry bear may burst out of the thicket and find you in his way—nothing but you between him and near-by freedom—gentlemen, it tests nerve!

Buck ague is not the effect of fear. In fact, fear has nothing to do with it. It is a tremor and a galloping of the heart that comes from over-anxiety lest you should fail to score. Precisely the same seizure may come upon you on the target range. That is the only place that I ever experienced it. There is no telling when it may strike. I have known seasoned sportsmen to be victimized by it. Yet, when the critical moment does come, it often turns out that the man who has been shaking like a leaf from pent-up anxiety suddenly grows cold and steady as a rock. Especially is this apt to be the case when a fighting beast comes suddenly in view. Instantly the man's primeval instincts are aroused; his fighting blood comes to the surface; the spirit of some warrior ancestor (dead, maybe, these thousand years) possesses and sways your mild-eyed modern man, and he who trembled but a moment ago now leaps into the combat with a wild joy playing on his heart strings.

CHAPTER XII

AXEMANSHIP—QUALITIES AND UTILIZATION OF WOOD

Next to the rifle, a backwoodsman's main reliance is on his axe. With these two instruments, and little else, our pioneers attacked the forest wilderness that once covered all eastern America, and won it for civilization.

In the clearing and in lumber works the favorite axe is a double-bitt with 4½ to 5-pound head. One blade is ground thin and kept whetted keen, for chopping in clear timber. The other is left with more bevel, as that is advantageous in splitting, and the edge, although sharp, is rather stunt, so that it will not shiver against a knot, or nick badly when driven through into the earth, as may happen when cutting through roots. A professional chopper, who works only at felling trees and cutting off "lops" (the branching tops) will grind both blades thin. For him, too, the double-bitt is best, since most of its weight is back in line with the cutting edge, and so it bites deep, although driven with little force. The helve of such an axe, of course, is straight, and one bought at a store should be shaved considerably thinner on both sides; then it is not so clumsy, lies in the hands more compactly, does not cramp the fingers and will not jar the hands, as it has some spring.

A double-bitted axe is dangerous in any but expert hands—more so than a loaded gun—and would be a menace lying around in camp, for, even when stuck in a tree or chopping-block, one edge is always exposed. I have given elsewhere (Vol. I., pp.

113-114) other reasons why a light single-bitt is the best axe for a camper, and have told how to select such a tool and care for it.

GRINDING AXES.—A new axe must be ground before it is fit for use. Do this on a grindstone (or have it done where they have a power grindstone) using water freely so the steel will not overheat. The average "cutler and grinder" in a city would make a quick job of it on an emery wheel, and ruin the temper. Since you will do much more chopping than splitting, you want the blade thin. Start grinding well back on the blade, and work out to the edge until most of the bevel has been ground off, but leave a little of it between the center and the outside corner; that is, the blade should be thickest at a point a little beyond the center, so it will not "bind" (stick fast in wood) and so that it will spring a chip loose. Then whet off the wire edge with a stone. Make or buy a leather sheath for the axe-head, riveted to prevent cutting through (see illustrations in outfitters' catalogues).

FITTING AXE-HELVES.—A broken axe-helve is not an uncommon accident in the woods, and it is a very serious one until a new helve is made and fitted. Now it sometimes happens that the stub of the old handle cannot be removed by ordinary means: it must be burnt out. To do this without drawing the temper of the steel might seem impracticable; but the thing is as simple as rolling off a log, when you see it done. Pick out a spot where the earth is free from pebbles, and drive the blade of the axe into the ground up to the eye. Then build a fire around the axe-head—that is all. If the axe is double-bitted, dig a little trench about six inches deep and the width of the axe-eye, or a little more. Lay the axe flat over it, cover both blades with two inches of earth, and build a small fire on top.

In making a new axe-helve, do not bother to make a crooked one like the store pattern. Thousands of expert axemen use, from preference, straight handles in their axes—single-bitted axes at that.

I have seen such handles full four feet long, to be used chiefly in logging-up big trees. Two feet eight inches is long enough for ordinary chopping. To smooth any article made of wood, when you have no sandpaper, use loose sand in a piece of leather or buckskin.

Split the eye end of the helve before driving it in. Make the wedge thin, and of even taper. Leave a little of it protruding, at first, for green wood soon will shrink and you must tighten it up.

How To Chop.—To be expert with the axe, one must have been trained to it from boyhood. A novice, however, can learn to do much better than bungle if he observes a few simple directions, watches a good chopper, and uses his wits in trying to "catch on."

Practice until you can hit the same spot repeatedly. Precision, rhythmical strokes, good judgment as to where a cut will do the most good; these are the main points to strive after.

Beginners invariably over-exert themselves in chopping, and are soon blown. An accurate stroke counts for much more than a heavy but blundering one. A good chopper lands one blow exactly on top of the other with the precision and regularity of a machine; he chops slowly but rhythmically, and puts little more effort into striking than he does into lifting his axe for the blow. Trying to sink the axe deeply at every stroke is about the hardest work that a man can do, and it spoils accuracy.

Try your axe first on saplings up to six inches in diameter. A little one is downed with two strokes. Bend it over so its fiber is strained on one side, hit it a clip with the axe in one hand, then similarly on the other side. A larger one is notched on each side, like a tree (see below) but does not need to have the large notch blocked out.

When cutting saplings that are to be dragged to camp, throw them with tops in the opposite direction from camp, so they can easily be dragged out by the butts; otherwise you will have to slew them around so the branches will not catch in everything.

Before starting to fell a tree, clear away all underbrush and vines that are within reach of the extended axe, overhead as well as around you. Neglect of this precaution may cripple a man for life.

FELLING A TREE.—Before starting to chop down a tree, decide in which direction you wish it to fall. This will be governed partly by the lay of the ground and the obstacles on it. The tree should fall where it will be easy to log up. Most trees lean more or less out of plumb, or have a heavier growth of branches on one side than on the other. If there is nothing to interfere, drop it on the side

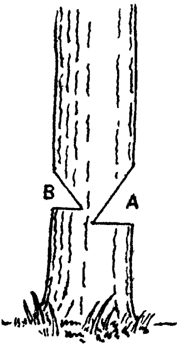


Fig. 36.—Felling Tree

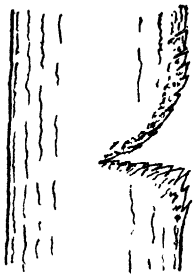


Fig. 37.—Boggled Notch

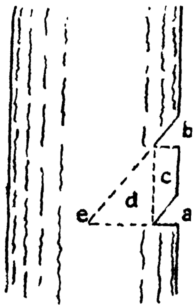


Fig 38.—True Notch

toward which it is naturally inclined to fall. In a thick forest, throw it in such direction that it will not lodge on some other tree in falling. It is both difficult and dangerous for anyone but an expert to bring down a lodged tree. Don't try to throw a tree against the wind, if there is a strong breeze blowing.

Now, suppose you decide to throw the tree to the south. First cut a notch (kerf) on the south side of the tree, half way through the trunk (*A* in Fig. 36). A novice would make this notch by starting with a small nick and laboriously enlarging it by

whacking out from the upper side one layer of chips after another. Soon he would be driving his axe in at too sharp an angle, and his work would grow harder and harder as he got to cutting more and more nearly straight across the grain (Fig. 37). Finally the inside of the notch would get so narrow that he would wedge his axe fast. The right way is shown in Fig. 38. Make a nick at *a* as guide then another at *b,* a little higher above *a* than half the thickness of the tree. Chop alternately at these notches, and split out the block *c* with a downward blow of the axe. Proceed in this way until the notch is finished, making as big chips as you can. A green axeman is known by the finely minced chips and haggled stump that he leaves.

If the tree is of such wood as is easy to cut, make the cut *ae* as nearly square across the butt as you can. To do this keep the hand that holds the hilt of the axe-helve well down. But if the tree is hard and stubborn to fell, or if you are rustling firewood in a hurry, it is easier to make this cut in a slanting direction, so as not to chop squarely across the grain, and then make the opposite one diagonally across it.

Having finished this south kerf (which is two-thirds the labor of felling the tree), now begin the opposite one, *b,* at a point three or four inches *higher* than the other. By studying the diagram, and taking into account the tree's great weight, you can see why this method will infallibly throw the tree where you want it, if it stands anywhere near perpendicular, and if there is not a contrary wind blowing. Comparatively few blows are needed here. When the tree begins to crack, step to one side. Never jump in a direction opposite that in which the tree falls. Many a man has been killed in that way. Sometimes a falling tree, striking against one of its neighbors, shoots backward from the stump like lightning. Look out, too, for shattered limbs.

If a tree leans in the wrong direction for your purpose, insert a billet of wood in the kerf *B,* and

drive a wedge or two above it in the direction of the kerf. A tree weighing many tons can be forced to fall in any desired direction by the proper use of wedges; and a good axeman, in open woods, can throw a tree with such accuracy as to drive a stake previously stuck in the ground at an agreed position. He can even do this when a considerable wind is blowing, by watching the sway of the tree and striking his final blow at the right moment.

Logging Up.—When the tree is down, trim off the branches for firewood, if the stuff is good for

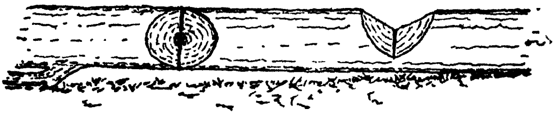


Fig. 39.—Logging Up

fuel (on the fuel values of trees see Vol. I., pp. 236-239). Then log up the trunk. When a novice tries to cut a log in two he stands in front of it and chops on the farther side until he has most of it and a good part of the top hacked out. Then he realizes that he is "up against it," for he cannot turn the tree over to get at the under side. The axeman must stand on the prostrate trunk, with his legs well apart, and cut down between his feet. This, to a beginner, looks like a risky performance; yet I have seen one of my woodland neighbors, who professes to be "only a triflin' hand with an axe," stand on a slender tree-trunk that was balanced about ten feet over a gulch, whack away between his feet, with the trunk swaying several inches at every stroke, nor did he step over on the main trunk until two or three light "draw cuts" sufficed to cut the end log free. But such a performance is tame compared with the feats of axemanship that regular choppers and river drivers do every day as a mere matter of course.

Make the outside chip not less in length than the

diameter of the log. This will seem absurdly long, until you have struggled futilely to "nigger" a log in two. Make two outside nicks, as in felling a tree, split out the block between them, and so go on, making big chips, and cutting at a considerable angle to the grain of the wood instead of across it. Chop straight down, so that when you get to the center of the trunk the bottom of your kerf will be perpendicular (Fig. 39). Usually the trunk is held a little off the ground by broken limbs on the under side of the top. If not, then, when you work close to the ground, look out for pebbles (rather scrape them away beforehand). A nick in the axe will make your work doubly hard. Before felling a tree on stony ground it is well worth while to place a small log across the way for the butt of the tree to fall on, so as to keep it off the ground.

Speaking of nicks in the axe, beware of cutting into hemlock or balsam knots; in trimming limbs close to such trees you can ruin the best steel that ever was made, for they are almost as hard as glass. If it must be done, strike gentle blows; hold the axe-head exactly perpendicular to the spot struck, and rigid, so it cannot glance in the least. The trick is similar to that of driving a bowie through a silver dollar without spoiling the knife's edge.

Having cut one notch half through the trunk, go on to the next ones until the end piece is reached; then turn around and work back until all cuts have been severed.

In working up crooked branches into firewood lengths, have something solid under the spot to be cut. If you don't, sometime a billet will fly up and hit you in the face. I have seen more than one man who had lost an eye in that way.

SAWING.—If there is a sharp and well set cross-cut saw in the outfit, it makes the work of felling and logging a great deal easier. The veriest tyro

can soon learn to saw tolerably well. Observe that your sole duties are to pull and help guide the saw straight. If you push, as one would with a buck-saw, the other fellow may let you do all the work. If you don't do your share of the pulling, your partner, if he be a woodsman, is apt to remonstrate "Say, you! I don't mind you riding the saw, but don't drag your feet."

To fell with a saw, first cut a small notch with the axe on the side toward which you want the tree to fall. Then saw from the opposite side, beginning a little higher than the notch, and sawing diagonally down to meet it. When the saw gets well into the wood it will begin to bind from the weight of the tree. Then relieve it by driving a wedge or glut into the kerf behind the saw. Drive the wedge in still farther as you progress, and it will tilt the tree in the right direction. When you hear the first premonitory crack, or see that the tree is near the toppling point, one man will quickly remove the handle at his end; the other will saw away until the tree sways, and then pull the saw out. A log should be laid for the butt to fall on.

In sawing up large logs, wedges are used in the same way to keep the saw running free.

Qualities of Woods.—The working qualities of common woods ought to be known by every one who has occasion to use timber, and especially by a woodsman, who may at any time be driven to shifts in which a mistake in choosing material may have disagreeable consequences. A few simple tables are here given, which, it is hoped, may be of assistance. Only common native trees are included. The data refer to the seasoned wood only, except where green is specified. Such tables might easily be extended, but mine are confined to the qualities of most account to campers and explorers, and to trees native to the region north of Georgia and east of the Rocky Mountains.

Very Hard Woods

Osage Orange (hardest),
Dogwood,
Black Haw,
Yellow Locust,
Post Oak,
Overcup Oak,
Sugar Maple,
Crab-Apple,
Persimmon,
Hickory,
Service-berry,
Black Jack Oak,
Chestnut Oak,
Mountain Laurel,
Winged Elm.

Hard Woods

Other Oaks,
Hornbeam,
Ash,
Elm,
Cherry,
Beech,
Tupelo,
Red-bud,
Red Maple,
Holly,
Sycamore,
Yellow Pine,
Pecan,
Black Birch,
Hackberry,
Plum,
Sourwood,
Sour Gum,
Walnut,
Silver Maple,
Mulberry,
Honey Locust,
Yellow Birch.

Very Soft Woods

Spruce,
Balsam Poplar,
White Pine,
Pawpaw,
Aspen,
Balsam Fir,
Catalpa,
Buckeye,
Basswood,
Arbor-vitae (softest).

(Common woods not mentioned above are of medium softness.)

Very Strong Woods

Yellow Locust,
Yellow Birch,
Shingle Oak,
Shellbark Hickory,
Yellow Pine,
Hornbeam,
Service-berry,
Big-bud Hickory,
Basket Oak,
Pignut Hickory,
Chestnut Oak,
Black Birch,
Spanish Oak,
Sugar Maple,
Beech,
Osage Orange,
Bitternut Hickory.

Strong Woods

Other Oaks,
Paper Birch,
Silver Maple,
Red Birch,
Dogwood,
Ash,
Rock Elm,
Water Locust,
Chinquapin,
Honey Locust,
Tamarack,
Loblolly Pine,

Persimmon,
Plum,
White Elm,
Cherry,
Red Pine,
Slippery Elm,
Black Walnut,
Sour Gum,
Red Maple.

Very Stiff Woods

Yellow Birch,
Sugar Maple,
Spanish Oak,
Hornbeam,
Paper Birch,
Tamarack,
Yellow Pine,
Black Birch,
Shellbark Hickory,
Overcup Oak,
Yellow Locust,
Beech.

Very Tough Woods

Beech,
Osage Orange,
Water Oak,
Tupelo.

Tough Woods

Black Ash,
Basswood,
Yellow Birch,
Dogwood,
Sour Gum,
Hornbeam,
Basket Oak,
Overcup Oak,
Yellow Pine,
Black Walnut,
White Ash,
Paper Birch,
Cottonwood,
Elm,
Hickory,
Liquidambar,
Bur Oak,
Swamp White Oak,
Tamarack.

(Saplings generally are tougher than mature trees of the same species.)

Woods that Split Easily

Arbor-vitae,
Basswood,
Cedar,
Chestnut,
Slippery Elm (green),
Hackberry,
The Soft Pines,
Spruce,
Ash,
Beech (when green),
White Birch,
Black Birch (green),
Dogwood (green),
Balsam Fir,
Basket Oak,
White Oak,
Red Oak,
Shingle Oak,
Black Oak,
Water Oak.

Woods Difficult to Split

Blue Ash (seasoned),
Buckeye,
White Elm,
Sour Gum,
Box Elder,
Wild Cherry,
Winged Elm (unwedgeable),

Liquidambar,	Hemlock,
Sugar Maple (seasoned),	Honey Locust (seasoned),
Tupelo (unwedgeable),	Sycamore.

Woods that Separate Easily into Thin Layers

Black Ash,	Basket Oak.

Flexible, Pliable Woods

Basswood,	Elm,
Hackberry,	Big-bud Hickory,
Red-bud,	Yellow Poplar.
Witch Hazel,	

Springy Woods

Black Ash,	White Ash,
Hickory,	Hornbeam,
Honey Locust,	Yellow Locust,
White Oak,	Osage Orange,
Service-berry,	Spruce.

Woods Easily Wrought

Basswood,	Black Birch,
Paper Birch,	Red Birch,
Buckeye,	Butternut,
Catalpa,	Cedar,
Cherry,	Chestnut,
Cottonwood,	Cypress,
Hackberry,	Red Maple,
Silver Maple,	White Pine,
Yellow Poplar,	Black Walnut.

Compact Woods (Not Liable to Check)

Arbor-vitae,	Red Mulberry,
The Ashes,	Basket Oak,
The Aspens,	Bur Oak,
Basswood,	Willow Oak,
Balsam Fir,	Pecan,
The Birches (except White Birch),	Persimmon,
	Gray Pine,
Box Elder,	Jersey Pine,
Buckeye,	Long-leaved Pine,
Butternut,	Pitch Pine,
Catalpa,	Red Pine,
The Cedars (very),	Short-leaved Pine,
The Cherries,	White Pine,
Cucumber,	The Poplars,
The Elms,	Red-bud,
Hackberry,	Silver-bell,
Big Shellbark Hickory,	Sorrel Tree,
Water Hickory,	The Spruces,

Holly (very),
Hop Hornbeam,
Laurel (very),
The Magnolias,
The Maples,
Tamarack,
The Thorns,
Witch Hazel,
Yellow Wood

Woods Liable to Check in Seasoning

Beech,
Chestnut,
Dogwood,
Hickory (except Shellbark)
Yellow Locust,
Sassafras,
Black Walnut,
White Birch,
Crab-apple,
Sour Gum,
Hornbeam,
Most Oaks,
Sycamore.

Woods Liable to Shrink and Warp

Chestnut,
White Elm,
Hemlock,
Liquidambar,
Loblolly Pine,
Yellow Poplar,
Cottonwood,
Sour Gum
Shellbark Hickory,
Pin Oak,
Sycamore.

Woods Difficult to Season

Beech,
Sour Gum,
Red Oak,
Water Oak,
Cottonwood,
Sugar Maple,
Rock Chestnut Oak,
Osage Orange,

Woods that Can Be Obtained in Wide Boards Free from Knots

Basswood,
Cypress,
Cottonwood,
Yellow Poplar,

Woods Durable in Soil, Water and Weather

Arbor-vitae,
Catalpa,
Cherry,
Cucumber,
Slippery Elm,
Juniper,
Honey Locust,
Mulberry,
Chestnut Oak,
Post Oak,
Swamp White Oak,
Osage Orange,
Pitch Pine,
Tamarack,
Butternut,
Cedar,
Chestnut,
Cypress,
Hop Hornbeam,
Kentucky Coffee Tree
Yellow Locust,
Bur Oak,
Overcup Oak,
Rock Chestnut Oak,
White Oak,
Yellow Pine (long leaved)
Sassafras,
Black Walnut.

Perishable Woods

White Birch,
Paper Birch,
Hackberry
Black Jack Oak,
Spanish Oak,
Loblolly Pine,
Service-berry,
Box Elder
Silver Maple,
Pin Oak,
Water Oak,
The Poplars,
Sycamore.

(Most woods are durable when not exposed to alternate wetting and drying. Sapwood is more liable to decay than heart-wood, as a rule, but this is not true of Paper Birch.)

Resinous Woods

Gray Pine (very) ,
Jersey Pine (very),
Long-leaved Pine (very),
Pitch Pine (very),
Red Pine,
Short-leaved Pine,
The Spruces.

Close-grained Woods

Blue Ash,
The Aspens,
Basswood,
Red Bay (very),
Beech, (very),
Black Birch,
Paper Birch (very),
Red Birch,
White Birch,
Yellow Birch,
Box Elder,
Buckeye,
The Cedars (very),
The Cherries,
Cottonwood,
Crab-apple (very),
Cucumber,
Cypress,
Dogwood,
Rock Elm (very),
Slippery Elm (very),
Winged Elm very),
Big Shellbark Hickory (very),
Bitter-nut Hickory,
Mocker-nut Hickory (very),
Pig-nut Hickory,
Water Hickory (very),
Holly (very),
Hornbeam (Ironwood),
Hop Hornbeam (very),
Laurel,
Liquidambar,
Yellow Locust,
Magnolia,
The Maples,
Basket Oak,
Bur Oak,
Chestnut Oak,
Overcup Oak,
Post Oak,
Rock Chestnut Oak,
Swamp White Oak,
White Oak,
Osage Orange (extremely),
Pecan,
Persimmon (very),
Short-leaved Pine (generally),
White Pine (very),
Plum,
The Poplars,
Service-berry,
Silver-bell,
Sorrel Tree (very),
The Spruces,
Sycamore (very),
The Thorns,
Tulip,
Witch Hazel (very),
Yellow Wood.

Very Heavy Woods

Chestnut Oak,	Pig-nut Hickory,
Shellbark Hickory,	Mocker-nut Hickory,
Hop Hornbeam,	Basket Oak,
Overcup Oak,	Persimmon,
Post Oak,	Service-berry,
Flowering Dogwood,	Swamp White Oak,
Big Shellbark Hickory,	Osage Orange.

Very Light Woods

White Basswood,	White Spruce,
Box Elder ,	Cottonwood,
Sweet Buckeye,	Balsam Fir,
Hemlock,	White Pine,
Yellow Poplar,	Balsam Poplar,
Quaking Aspen,	White Cedar,
Butternut,	Arborvitae.

(The weight of seasoned wood is no criterion of the weight of the green wood, which must be learned by experience. For example, the dry wood of the Sequoia, or California Big Tree, is lighter than White Pine, but the freshly cut log is so heavy that it will scarcely float in water. Black Walnut and Sour Gum are only moderately heavy when seasoned, but the green logs will not float.

WOODS FOR SPECIAL PURPOSES.—These tables are only general guides. Individual trees of the same species vary much in their qualities. In selecting wood for a special purpose one will be governed, of course, by the material at hand. Suppose he wants a very hard and close-grained wood: He may choose, according to circumstances, beech, birch, dogwood, rock elm, mocker-nut (white-heart) hickory, holly, hornbeam, yellow locust, sugar maple, Osage orange, persimmon, service-berry, or whatever he can get on the spot that will answer his purpose. If it must also be strong, tough, elastic, or have some other merit, the choice will be narrowed.

Timber cut in the spring of the year, when the sap is up is much inferior in quality and durability to that which is cut in autumn and winter, when the sap is down. Sap softens the fibers, sours in cut timber, and carries the seeds of dry-rot or decay.

HEWING TIMBER.—To flatten a log, as for a

bench seat, if it will not split straight: Score the top of it with notches of uniform depth, like saw teeth, but as far apart as the stuff will block off evenly; then chop out the blocks, and hew smooth (along the dotted line *A B* in Fig. 40).

When much hewing is to be done, a broadaxe or adze is used; but both of these tools are difficult and dangerous for an inexperienced man to handle, and neither of them will be obtainable except where skilled artisans can be hired to wield them.

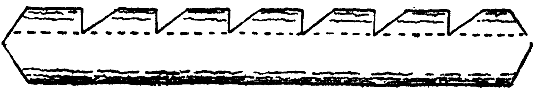


Fig. 40.—Scoring and Hewing

Splitting Timber.—Logs split through the center into half-logs with one face flat are very useful in cabins and about camp, for tables, benches, shelves, and other rustic furniture. They also are employed in making slab camps, puncheons for flooring, and small enclosed cabins. In the latter case, split logs have certain advantages over round ones. They take only half as many trees, they are easier for one or two men to handle, easier to notch for the corners, make close joints without much, if any chinking, and leave a flat surface for the interior of the cabin. They may also be used vertically instead of horizontally, and in this way short logs can be utilized.

The only implements needed in splitting logs are an axe (single-bitted) and a maul and some wooden wedges made with the axe. The maul is made in club shape (Fig. 41). Beech, oak and hickory are good materials, but any hardwood that does not splinter easily will do. Choose a sapling about five inches thick at the butt, not counting the bark. Dig a little below the surface of the ground and cut the sapling off where the stools of the roots begin. (The wood is very tough here, and this is to be used for the large end of the maul, which should be

about ten inches long). From this, forward, shave down the handle, which should be twenty inches long. Thus balanced, the maul will not jar one's hands.

Gluts (Fig. 42) are simply wooden wedges. The best woods for them are dogwood and hornbeam or ironwood, as they are very hard and tough, even when green; but use whatever is handy. Chop a sapling of suitable thickness, and make one end wedged-shaped; then cut it off square at the top; and so continue until you have all the gluts you

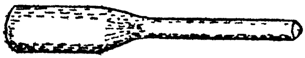


Fig. 41.—Maul

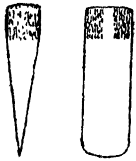


Fig. 42.—Gluts (edge and face)

want. It takes no mean skill to chop a glut to a true wedge shape, and much depends upon getting the angles and surfaces correctly proportioned. A novice is apt to make a glut too short and thick, but it must not be quite so slender as a steel wedge, for it would splinter too readily.

In splitting timber, one must observe the grain and structure of the wood. Naturally, he would select stuff that is straight-grained; but that is not all. Fig. 43 shows the end of a log that has been sawed off square. Observe that there are four kinds of structure to be considered: (1) the bark, (2) the light-colored sapwood next to the bark, (3) the mature wood, (4) the dark-colored heartwood. It is seldom that heartwood splits evenly. Outside of it we notice the concentric rings of annual growth; also the medullary rays, radiating from the center like spokes of a wheel. Both of these continue through the sapwood, though not so shown here, as they are less conspicuous in it.

Now the natural lines of cleavage are along the

medullary rays, which are pithy. Hence a log can be split straight through the center (if clear and straight-grained) from any point on the circumference, but if you try to make other splits *parallel* with this, you will have trouble, for you are attempting to cross the rays at an angle. Some trees can be split, by careful manipulation, into three slabs or four slabs with parallel faces, but usually it will not pay you to try it.

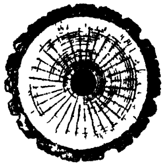


Fig. 43.—Cross-section of Tree Trunk

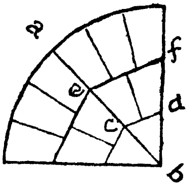


Fig. 44.—Rail Splits

The natural way of cleavage is shown in Fig. 44, which illustrates the method of splitting rails. First the log is split through the center, then each half similarly. Then one of the quarters is split through the line *ab,* following, as you see, a medullary ray. Next the point of the wedge is split off across *cd* (direction of annual rings), forming one rail. The remaining billet is again split in the same direction, *ef,* and its separate parts are now split along the rays, forming, in this instance, five rails. The number, of course, will depend upon the size of the log.

To split a log: Begin at the smaller or top end, because it splits easiest that way. Advantage may be taken of a natural crack or check, but if there is none, take axe in one hand, maul in the other, and start a crack. Into this drive two wedges, as in Fig. 45, and others into the longitudinal crack on top as it opens. To ensure a straight split: First score the log lengthwise with the axe, driving the bitt in with a moderate tap or two, at one place, then extending the cut backward with another, and so on, finally splitting this apart with gluts. A free-split-

ting log of moderate size can be split without wedges, by using two axes, one working behind the other.

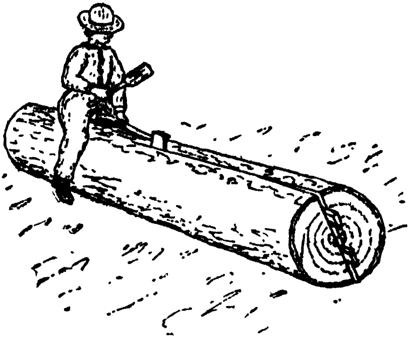


Fig. 45.—Splitting a Log

Slabs for siding and puncheons for flooring are thus split out and then hewn smooth on the flat side. Almost any tree that splits straight will do. Those commonly used are chestnut, oak, ash, poplar, cedar, spruce and pine. A small tree is merely split through the center, and the halves laid with round side out, or down, as the case may be. A larger one is first halved, and then each half is split parallel with the flat side, if the grain permits, making four puncheons from each log. Very large ones are split into long bolts, in the same manner as clapboard bolts (see below), thus making a considerable number of narrow puncheons from each log, which are to be hewn of even thickness on both edges.

Puncheons usually are cut so that two lengths equal the length of the room—eight-foot puncheons for a sixteen-foot room, and so on. They are laid by fitting the rough side to the sleepers. It is best to leave them loose until they have seasoned; then true up their edges, spike them down, and you will have a tight floor of uncommon solidity and warmth.

Selecting a "Board Tree."—If clapboards or

other thin pieces are to be riven, a nice judgment must be exercised in selecting the right kind of tree. Wood for this purpose must be sound, straight-grained and springy. If brash or doty, it will not do at all. Nor will "any old wood" do that splits easily; it must split straight and make thin boards.

The species of tree will depend, of course, on what growths one has to choose from. Cedar is best, as it is easily riven and is very durable. Boards from five to six feet long can be split out of cedar with no other tool than an axe, and a club or mallet to tap it. If the board shows a tendency to "run out," the workman changes ends and makes another split back toward the first one, or "coaxes" it after the manner to be described hereafter. Such axe-riven boards or shingles are commonly called "splits."

Here in the southern Appalachians, our first choice for clapboards is "mountain oak," when we can find one that splits well. Its wood resembles that of live oak in hardness and texture. Otherwise we take white, black, red, or water oak. White and yellow pines are much used; occasionally yellow poplar. A young, quick-growing chestnut tree makes good 18-inch shingles, but not the longer clapboards or "shakes," as chestnut is prone to "run out" when long splits are made. Mature chestnut trees generally are full of worm-holes. Sometimes a hemlock is found that will make clapboards, if split bastard (the way the rings run), but, as a rule, hemlock has a spiral grain.

When a suitable species is found, the next thing is to pick out a good "board tree." This takes an experienced eye, so leave it to a native woodsman, if you can. The way he does it is not easy to explain. First he looks for a straight trunk, free from knots, limbs, and dote. It should be not less than two feet thick. Then he scans the bark. If the ridges and furrows run straight, in a general way, parallel with the trunk, it is an indication of straight grain. An oak with a large fork is likely to split well.

But there is more than this in picking a board-

tree: the wood should be not only separable but springy. The woodsman will tell you that he "senses" this; and he does, to the extent that his choice is guided by no rule nor process of reasoning. Twice out of three times he is right when he says "That tree 'll do;" nine times out of ten he is right when he says "That tree 's no good." Experience has taught me that a tree with a certain "look" is likely timber, but I can't, for the life of me, describe that look. You may have to split a big block out of a tree, test its cleavage, and try several other trees before you find a good one. This is bad practice, but not so bad as felling, sawing off a cut, and then leaving the tree to waste utterly.

Clapboards.—To rive clapboards or shingles from the green tree is now a lost art, outside of the backwoods. Not one carpenter in fifty, nowadays, can show you how. Yet it is an art well worth knowing for hunters and others who may want to go, season after season, to the same locality, and wish a snug shack on the place for regular quarters. Since good hunting seldom is found in the neighborhood of a sawmill, a lumber yard, or a wagon road, the crux of the cabin scheme is how to get roofing material. Bark is flimsy and will scarce outlast the season. Tarred paper—what is more hideously incongruous than tarred paper over honest log walls? Anyway, paper requires boards underneath.

The thing to do is to rive clapboards from trees that grow on the spot. A clapboard is simply a thin board, from two to four feet long, split or worked with a froe from straight-grained timber. It is a little thicker along one edge than the other, being split from bolts, as shown in Fig. 47. A clapboard roof is dependable. It harmonizes better than any other with the general woodsy effect. When properly laid, it is storm-proof, and will not cup. It will last a generation.

The tools required are few: An axe or two, a crosscut saw, a pair of steel wedges, and a froe. A maul for the wedges and gluts, and a mallet of similar

shape, but smaller, for the froe, are made on the spot. The froe is a tool that seldom is seen outside of the backwoods. Any blacksmith on the edge of the wilderness can make one for you. Its shape is shown in Fig. 49. The blade should be straight (old ones that have yielded to the mallet and become swaybacked are hard to manage). Let it be about 14 inches long, rather thick, and stunt-edged, as it is for splitting, not cutting. Its weight will be about five pounds. A green stick will do for the handle.

When the right tree is found, throw it in the best place for working up, and saw off a cut of 2½ to 3 feet. The butt cut usually is not so good as the upper ones, being tougher. Turn the cut up on end, and, with a single-bitt axe and mallet, mark an indentation straight across the center of the block. Do not tap hard until you come to the end of the line; then strike vigorously, and the block will fall in halves. If you struck hard from the first, the split might run off to one side. In the same way, split the halves into quarters, and these into bolts or

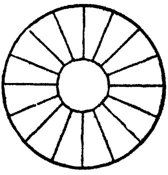


Fig. 46.—Splitting Out Bolts

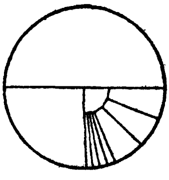


Fig. 47.—Block for Clapboards

billets of convenient size for riving (see Fig. 46). A bolt is usually of such thickness, that it will make eight boards or shingles—say five inches across the outside.

Now split out the heartwood of each bolt by laying the axe across and tapping it. Heartwood is useless, for it won't split well. In some trees the heart is so tough that it is advisable, instead of halving and quartering your cut, to just split in toward

the cut, all around, to bolt size, and then knock out the bolts by driving the axe in at right angles to the cuts, leaving the heart as one solid core (Fig. 47). Skin off the bark, and your bolts are ready to rive.

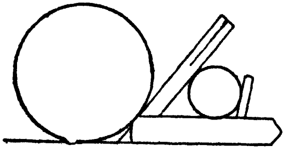


Fig. 48.—Brake for Riving Boards

The next thing is to make a brake. This may be simply the fork of a limb, as in Figs. 49 and 51. Another way is to lay two blocks against the prostrate trunk of your board tree, at right angles to it, like fire dogs, and a yard or so apart; on them lay a small log, parallel with the trunk, and drive stakes outside this "roller" to keep it from rolling more than six or eight inches away from the trunk (Fig. 48). The office of the brake is to clamp one end of the bolt while you are riving with the froe.

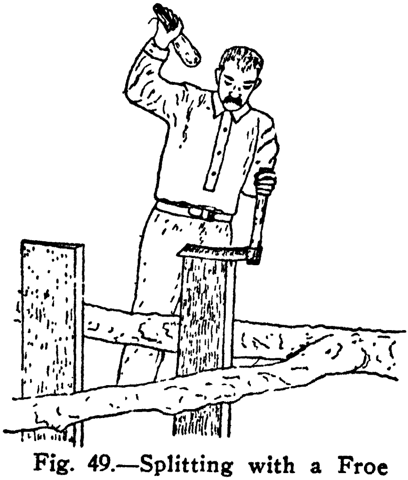


Fig. 49.—Splitting with a Froe

Now take up your froe. Stand one of the bolts on end, lay the froe's edge accurately along the center of one end, and split the bolt in twain by tapping with the mallet and springing your cleft

apart with the froe (Fig. 49). Take one of these halves and rive it similarly into two equal parts.

At this stage (more surely at the next one) you must learn a new trick—the difference between riving and mere splitting, and how to govern the rift. The wood has a tendency to "run out" more toward one side than the other. If you went on just forc-

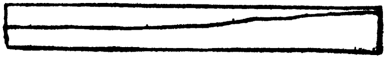


Fig. 50.—"Run-out" Rift

ing the froe down, the result would be a botch (as in Fig. 50). To prevent this, turn the block so that *the thicker side is down,* lay its lower end in the brake, open the cleft until you can insert your flat left hand (the froe will prevent pinching), and then *bear down* hard on the bottom (*thicker*) section while you work the froe gently up and down.

Fig. 51.—Springing the Rift

This will make your split run back again into the thicker section.

Having quartered the bolt, now carefully rive each quarter into two clapboards or shingles (Fig. 51). You may have to turn the piece three or four times in order to get boards of uniform thickness. It is right here that judgment and skill are called for.

With good wood, already bolted, an experienced hand can turn out about one thousand clapboards, or four thousand shingles, in a day. Experts do better.

Clapboards, although slower to make than short shingles, save time and labor in the end, because of their extra span, and because they can be nailed directly to rib poles running lengthwise of the roof, whereas shingles require strips of board or flattened poles laid across rafters and close together. The rib pole construction makes a prettier gable end than the usual way of boxing up the gable with boards, because courses of logs are carried all the way up into the peak. Sawed boards break rustic effect.

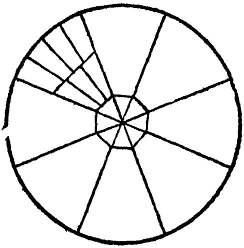


Fig. 52—Double Bolting for Shingles

Shingles.—However, if shingles be preferred, they, too, can readily be made from the green tree. These hand-made shingles, if finished by shaving smooth with a drawing knife, are superior to the mill product.

To make them, a large tree is chosen, and the cuts are double bolted (as in Fig. 52). Since the sides of the outer bolts are almost parallel, the unshaved shingles will be of nearly even thickness on both edges. In riving shingles the bolt is turned end-for-end every time a shingle is struck off, and the shingles are allowed to run out a little so as to be thinner at one end than at the other.

A rude but efficient shaving-horse is shown in Fig. 53. My partner and I made such a one in an hour out of a chestnut log, a dogwood fork, two sticks for legs, and a hickory wand. The log (*A B* in Fig. 53) is flattened on top to the rear of *C*. The far end rests on the ground and the near one is elevated on legs to such height that a man sitting in front of it will find *A* at the level of his elbows. The clamp

C D is pivoted in a slot by a wooden pin. (We had a chisel, but no auger; so we burned the hole out with a red-hot poker). Its head, *C*, may be cut as shown or formed of the stub of a natural fork. The end *D* is high enough to clear the ground, and at such distance from *A* that the operator can press against it with his foot, and thus clamp the head down on a shingle which is laid from *C* to *A*. A bowstring runs from *C* to the springy stick *E* inserted in the log a few feet back

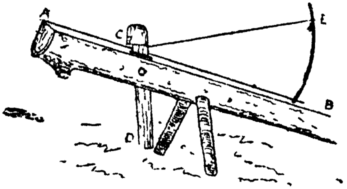


Fig. 53.—Shaving Horse

of the clamp, to hold the latter back out of the way when not in use. For ordinary cabins, the clapboards or shingles do not require shaving.

Shingles are best made of soft wood (cedar is first choice). Then, if stacked and seasoned, they will not cup. If oak shingles are seasoned they will split in nailing; consequently they are used green. Moderate cupping does not necessarily mean a leaky roof, but it is unsightly. Clapboards, although always laid green, cannot cup, because they are nailed at both ends. They should be laid thick edge to thick and thin to thin. A thin board will outlast a thick one and makes tighter joints.

Speaking of cupping—it is universally believed by backwoodsmen that green shingles surely will cup if laid at any other time than "the old of the moon." Twice out of three times they will cup anyway—but it is heresy to say so.

Long, Slender Splits.—When one is obliged to use wood that does not naturally split very straight, he still can rive out long and slender pieces of uniform thickness by careful manipulation. In his very

practical little book on *Camp and Trail Methods*, Mr. Kreps describes the following method that he uses in getting material for snowshoe frames out of white birch, which is the only good wood for the purpose that is to be found in the far northern woods:

"Look along the edges of the swamps and you will find long, slender birches with smooth bark. Select one of about six inches in diameter, free of knots and flaws for about ten feet. It should be straight, and there must be no twist to the grain of the wood. If the limbs of the tree are drooping, so much the better, as it is stronger wood. Avoid the red-barked kind, with upright limbs.

"Having found a good tree, fell it, cut off about ten feet, and lay this piece in a notch cut in an old log or stump. Now carefuly cut a groove the entire length of the stick, making it an inch or more deep. Do not strike hard when cutting this groove, or you will shatter the wood. When finished, turn the stick over and make a similar groove in the opposite side.

"Now go along the entire length and strike lightly with the axe in the bottom of the groove to start the split; turn the stick over and do the same with the other side.

"Next make two small wooden wedges, and, commencing at the end of the stick, driving one wedge in each groove, keep moving them along, and the stick will split nicely, following the grooves. If at any point the split is inclined to lead away from the groove, bring it back by cutting the contrary fibers.

"Now select the best of the two pieces and cut another groove the entire length, on the bark side. Split this the same as before and you will have the wood for two frames."

Quick Seasoning.—Green wood can be seasoned quickly, or rather have the sap driven out of it and the fibers hardened, by careful roasting in hot ashes or over the camp-fire. The old English word for such treatment of wood was "beathing." For the time being, this makes the wood soft and pliable, so that it can be bent into any required shape, or it can be straightened by hanging a weight from one end, or by fastening it to a straight form; but when the

wood has cooled, it becomes stiff, as if regularly seasoned.

One time when some of us were bivouacing in the mountains, Bob announced that he was going to catch a mess of trout in the morning. He had a line and some flies, but I wondered how he would extemporize a rod stiff and elastic enough for fly fishing. It didn't bother him a bit. The only straight and slender stick he could find right there was a box elder seedling. He trimmed it, removed the bark, and spent about an hour roasting it over the campfire, drawing it back and forth in his hands, so as not to overheat and crack it, and to temper the heat just right, according to thickness of the point treated. When the sap was roasted out, he hung the rod up to cool, and when that was done he had a one-piece trout rod with the necessary whippy action for fly fishing. Next morning he soon caught all we could eat.

BENDING WOOD.—Small pieces of green wood can be bent to a required form by merely soaking the

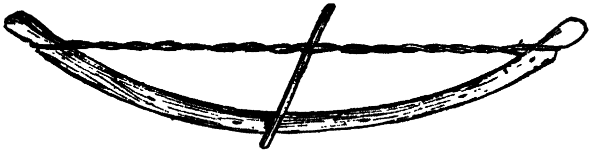


Fig. 54.—Spanish Windlass (for bending wood)

pieces for two or three days in water, but if it is desired that they should retain their new shape, they should be steamed. Small pieces can be immersed in a kettle of hot water. A long, slender one is suppled by laying it over the kettle, mopping it with boiling water, and shifting it along as required. Large pieces may be steamed in a trench partly filled with water, by throwing red-hot stones into it. Then drive stout stakes into the ground, in the outline desired, and bend the steamed wood over these stakes, with small sticks underneath to keep the wood from contact with the ground, that it may dry more

readily. If a simple bow-shape is all that is wanted, it can be secured by merely sticking the two ends of the wood into the ground and letting the bow stand upright to dry; or, use the Spanish windlass, as shown in Fig. 54.

CHAPTER XIII

TOMAHAWK SHELTERS—AXEMEN'S CAMPS—CACHES—MASKED CAMPS

"The simplest and most primitive of all camps is the 'Indian camp.' It is easily and quickly made, is warm and comfortable, and stands a pretty heavy rain when properly put up. This is how it is made: Let us say you are out and have slightly missed your way. The coming gloom warns you that night is shutting down. You are no tenderfoot. You know that a place of rest is essential to health and comfort through the long, cold, November night.

"You dive down the first little hollow until you strike a rill of water, for water is a prime necessity. As you draw your hatchet you take in the whole situation at a glance. The little stream is gurgling downward in a half-choked frozen way. There is a huge sodden hemlock lying across it. One clip of the hatchet shows it will peel. There is plenty of smaller timber standing around: long, slim poles, with a tuft of foliage on top. Five minutes suffices to drop one of these, cut a twelve-foot pole from it, sharpen the pole at each end, jam one end into the ground and the other into the rough bark of a scraggy hemlock, and there is your ridge pole. Now go —with your hatchet—for the bushiest and most promising young hemlocks within reach. Drop them and draw them to camp rapidly.

"Next, you need a fire. There are fifty hard, resinous limbs sticking up from the prone hemlock; lop off a few of these, and split the largest into match timber; reduce the splinters to shavings, scrape the wet leaves from your prospective fire-place, and strike a match on the balloon part of your trousers. If you are a woodsman you will strike but one. Feed the fire slowly at first; it will gain fast. When you have a blaze ten feet high, look at your watch. It is 6 P. M. You don't want to turn in before 10 o'clock, and you have four hours to kill before bed-time. Now, tackle the old hemlock, take off every

dry limb, and then peel the bark and bring it into camp. You will find this takes an hour or more.

"Next, strip every limb from your young hemlocks, and shingle them on your ridge pole. This will make a sort of bear den, very well calculated to give you a comfortable night's rest. The bright fire will soon dry the ground that is to be your bed, and you will have plenty of time to drop another small hemlock and make a bed of browse a foot thick. You do it. Then you make your pillow. Now, this pillow is essential to comfort, and is very simple. It is half a yard of muslin, sewed up as a bag, and filled with moss or hemlock browse. You can empty it and put it in your pocket, where it takes up about as much room as a handerchief.

"You have other little muslin bags—an' you be wise. One holds a couple of ounces of good tea; another sugar; another is kept to put your loose duffel in: money, match safe, pocket knife (when you go to bed). You have a pat of butter and a bit of pork, with a liberal slice of brown bread; and before turning in you make a cup of tea, broil a slice of pork, and indulge in a lunch.

"Ten o'clock comes. The time has not passed tediously. You are warm, dry, and well fed. Your old friends, the owls, come near the fire-light and salute you with their strange, wild notes; a distant fox sets up for himself with his odd barking cry, and you turn in. Not ready to sleep just yet.

"But you drop off; and it is two bells in the morning watch when you awaken with a sense of chill and darkness. The fire has burned low, and snow is falling. The owls have left, and a deep silence broods over the cold, still forest. You rouse the fire, and, as the bright light shines to the furthest recesses of your forest den, get out the little pipe, and reduce a bit of navy plug to its lowest denomination. The smoke curls lazily upward; the fire makes you warm and drowsy, and again you lie down —to again awaken with a sense of chilliness—to find the fire burned low, and daylight breaking. You have slept better than you would in your own room at home. You have slept in an 'Indian camp.'

"You have also learned the difference between such a simple shelter and an open-air bivouac under a tree or beside an old log."—("Nessmuk," *Woodcraft.*)

Why peel the old hemlock? Because the thick bark is resinous, is good to "brand up" a fire, and to

cook over. Those hemlock stubs by themselves are rather poor fuel—you took what was handy—but, as I have already warned, chop them off well above their butts where they join the log, or you will have a nicked hatchet.

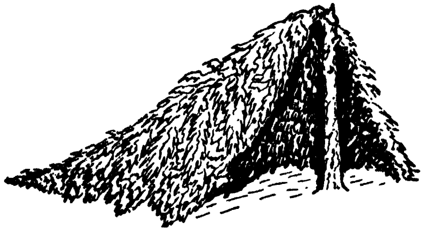


Fig. 55.—Lopped Tree Den

Nowadays it is prohibited, on public lands, to make a fire against the trunk of a tree, for it ruins the tree. The ridge pole can be supported by a low limb, or it can be set up on shears.

If one is alone, and needs nothing but a windbreak at night, a quick and easy way is to select a small, thick foliaged evergreen, cut the stem partly

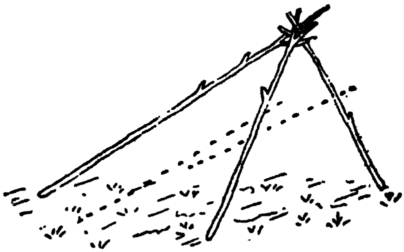


Fig. 56.—Straddle-bug Frame

in two at about five feet from the ground, then push the top over till it rests on the ground, the stem still being fast to the butt. Trim off the boughs from the inside, to use in thatching. Partially sever the upstanding limbs on the outside and let them hang down as part of the roof. Add your

thatching, and branches from nearby small trees, as may be needed to make your den wind-proof (Fig. 55). This will be little protection, however, against rain, as the angle of the ridge is not steep enough, unless the tree be cut higher.

Where no tree grows on a favorable place, one can erect very quickly a tripod of poles (Fig. 56) secured at the apex by interlocking forks, or by tying. No triangular framework, however, is satisfactory for more than one occupant, because, if there be two or more of you, the den must be made so deep that the angle farthest from the fire is sure to be cold and dismal. The tripod frame is improved by tying one end of a pole to each leg of the shears, about two-thirds of the way to the top, and letting the other end rest on the ground, so that the rear of the shelter will be nearer a semi-circle than a triangle.

This is what I call a "straddle-bug" frame (see dotted lines in Fig. 56). It is economical of time and material, as it takes but five sticks. It is a particularly good frame to use if one has a poncho or pack cloth, which is spread over the top, tied to the side bars, and the whole is then covered with boughs. This ensures a dry spot to sleep on, and makes a very snug shelter in snowy weather, as no wind can get through, nor snow-water leak through from the top (snow does not melt at the sides) from the heat of the camp-fire.

Brush Lean-to.—If two trees happen to stand in the right position, run a stout ridge pole horizontally from one to the other, secured in forks of low limbs, or in notches cut in the trees, or by nailing, or tying (use twisted withes, pliable rootlets, or bark straps, if you have no cord). Against this lay poles sloping backward to the ground like a shed roof. Fasten a cross bar on the back, and one on each side, to stiffen the frame and to support thatching. Cover the roof and sides with evergreen boughs (balsam, hemlock, or spruce) hanging them from ridge and cross bars by stubs of their branchlets, trim them

on the inside, and thatch them deeply outside with small boughs, beginning at the bottom, so that each layer will be overlapped by the one above it, like shingles. Lay the thatch with feathery tips down.

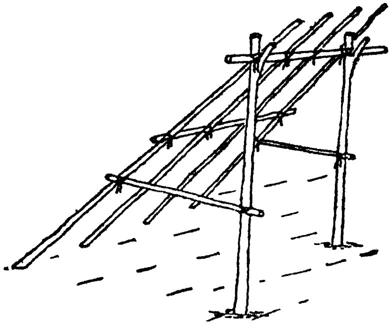


Fig. 57.—Stake Frame for Lean-to

When no trees grow where you want your bed, set up two forked stakes, slanting slightly outward at the butts so they will not need bracing, to hold your ridge pole (Fig. 57), and proceed as above. If the

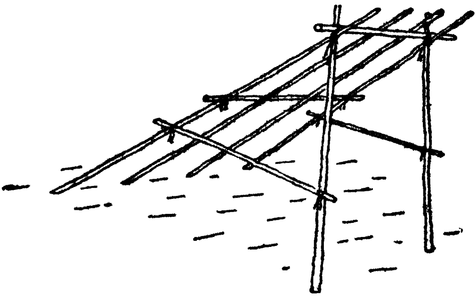


Fig. 58.—Shear Frame for Lean-to

ground is too stony or frozen to plant stakes in, use shear poles (Fig. 58), letting them flare outward so as to brace in every direction.

A frame must be stout enough, in winter, to hold up the weight of a snowfall. The lower the

frame, the less material needed. Five feet to the ridge is high enough for a "one-night stand."

Any such bower is delightfully woodsy and sweet-scented, but it is not good protection against long or heavy rain. Of course, it lasts only so long as the browse remains green.

Bough Beds.—Balsam makes the best bed, as it has thick, flat needles, soft and fragrant. Hemlock is next choice, then arborvitæ (white cedar) and spruce. Pine sprays are too scraggly. A bed of boughs or leaves will spread from under one if not held in place by something at the ends and sides; so, if practicable, cut four logs and stake them in a rectangle to keep the stuff in place. The fewer thick stems there are in your mattress, the easier you will sleep; but it takes a long time to make a browse bed of only the feathery tips; and you may be too hurried and weary.

For the first course use branchlets from eighteen inches to two feet long. Begin at the head end, lay them against the log, butts down, bottom or convex side up, and stick them in the ground with butts slanting only a little to the front, to make the bed springy. Then shingle another row of the fans in front of these, and so on down to the foot, leaving only the tips exposed. Then take smaller ones and stick them upright, tips inclined slightly to the head, all over the bed, as thickly as time and material will allow. Such a bed is luxurious in proportion to its depth and freshness. If the browse were merely laid flat on the ground it would pack hard and lumpy, and the sticks would soon find your ribs. The bed should be renewed with fresh stuff every two or three days.

Balsam twigs should not be cut, but snapped off. Grasp the stem with two front fingers underneath, pointing toward the tip, and thumb on top, then press downward with the thumb and give a quick twist of the wrist.

Where there are no evergreens, collect small green branches of willow, cherry, alder, or any tree or

shrub that is springy and supple. Lay a course of these on the ground and cover with moss, dead grass, dry leaves, or whatever soft stuff you can find. Green leafy branchlets, ferns, rushes, herbage, and so forth, will do, if you can get nothing better. Even if such a bed is not soft, it will serve as insulation between your body and the cold, damp earth, and that is far better than none at all.

BARK SHELTERS.—Almost any bark will peel freely in the spring, when sap is rising, and several kinds will peel all summer. Elm peels through eight months of the year, and some young basswood trees may be peeled even in winter. But, as a rule, if one wishes to strip bark in cold weather he will have to roast a log carfully without burning the outside.

Barking a tree generally kills it, and is prohibited on public lands. But in the far wilderness such barking as campers would do is not detrimental to the forest, which generally needs thinning out, anyway.

The bark of the following trees makes good roofs and temporary shelters, and is useful for many other purposes: Paper birch, cedar, basswood, buckeye, elm, pig-nut hickory, spruce, hemlock, chestnut, balsam fir, white ash, yellow poplar and cottonwood. (That of the paper birch and of cedar, is quite inflammable). Select a tree with smooth and faultless trunk. If it is a birch, choose one with bark that is thick, with few and small "eyes." If it is of a species that has rough, hard, furrowed bark on old trees, pick out a young one that still is smooth on the outside, or treat as described below.

For a temporary roof it will be enough merely to skin the bark off in long strips eight to twelve inches wide, lay a course lengthwise with the slope of the roof, convex side up, and then another on top of this with concave side up, so that the first course will form troughs to run off the water that is shed by the second (Fig. 59). One axeman can erect a rain-

proof shelter in this way, from the bark of young chestnut trees, for example, in less than an hour. It will not last long, however, as the sun will curl the troughs inward. If a tree is felled for the purpose of stripping its bark, first place a short log near the butt as a skid for it to fall on.

For neater and more permanent jobs the bark must be flattened, and the rough outer bark must be removed (except birch, which is always smooth), only the tough, fibrous, soft inner bark being used.

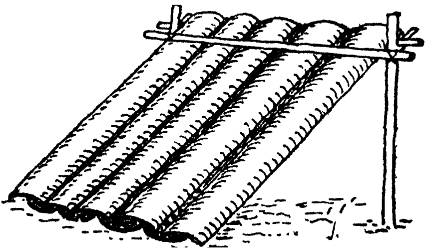


Fig. 59.—Bark Tilt

For rough work the outer bark may simply be "rossed" off with a hatchet, but for nice jobs the bark should be treated as described below.

If only a moderate-sized sheet is needed, the tree may not have to be felled. First girdle the tree just above the swell of the butt, by cutting through into the sapwood. Then girdle it again as high up as you can reach. Connect these two rings by a vertical slit through the bark. Now cut into wedge-shape the larger end of a four-foot length of sapling; this is your "spud" or barking tool. With it gently work the bark free along one edge of the upright slit, and thus proceed around the tree till the whole sheet falls off. If the girdles are 5 feet apart, a tree 2 feet in diameter will thus yield a sheet about 5 x 6⅓ feet, and a 3-foot tree will afford one 5 x 9½ feet. The bark is laid on the ground for a few days to dry in the sun, and is then soaked in water, which supples it and makes the inner bark easy to remove from the outer.

The frame for a bark lean-to is like that in Fig. 57 or Fig. 58. The roof is laid in courses, beginning at the bottom, and overlapping like shingles. It is secured in place by weight-poles. The sheets of bark at the sides can be tied to stakes by using bark straps.

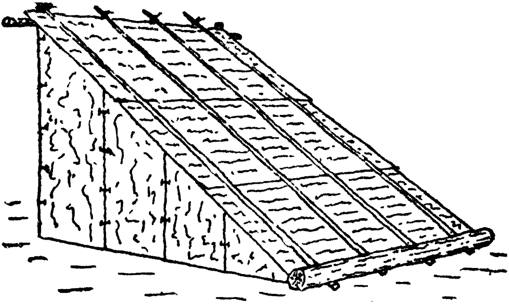


Fig. 60.—Bark Lean-to

or held in place by driving other slender stakes on the outside and tying them to the inner ones at the top (Fig. 60). Such a camp will last a whole season.

A bark teepee is made by lashing the tops of three poles loosely together, spreading them as a tripod,

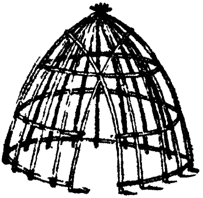


Fig. 61.—Beehive Lodge Frame

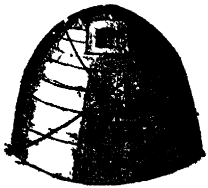


Fig. 62.—Beehive Lodge (covered)

laying other poles against them with their butts radiating in a circle, covering with bark as above, and holding it in place with other poles laid against the outside. A more commodious circular lodge (more head-room for its size) was formerly used by the Algonquin tribes of the East. It was of beehive shape (Figs. 61 and 62), and was covered with

skins or bark. The butts of the poles were driven into the ground and the tops bent over and tied together. Inner hoops were added as shown in the illustration, and the two crossed poles in front left openings for a doorway below and a smoke-vent above. If a rope or vine were run around near the top, pegged down at the bottom of the lodge on the opposite side, and a similar one used on the other side, such a structure would stand against a heavy gale. The Indians, so far as I know, did not do this, but I have shown the arrangement in Fig. 62.

A wikiup frame that is quickly set up can be made by driving six or more slender and flexible rods into the ground, in semi-circular or half-oval form, bending over those opposite each other, and twisting their

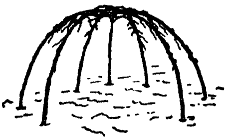


Fig. 63.—Wikiup Frame

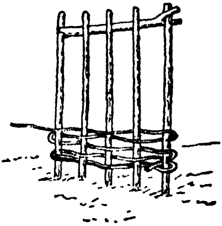


Fig. 64.—Wattled Work

tops together so that they hold without tying. In a thicket of seedlings, I have cleared out a circular space, bent over some of the tall, slender ones on the margin of this space, trimmed off the lower branches, interwoven the others, and so, in a jiffy, have had a wikiup frame that no wind could blow down (Fig. 63). The covering would be bark, evergreen boughs, or whatever I could rustle that would serve the purpose. A small fire built close in front would soon warm the little cubby. If there are prospects of rain, the top should not be bent over so far, but sloped like the one in Fig. 61.

Wattled Work.—A frame of any shape may be wattled to serve as foundation for a lasting thatch, or for daubing with clay. Bed bottoms and other

movable articles can be made in the same way. It also makes good fencing around a camp in a wild hog country. To illustrate the process, let us suppose you want to make a spring bed-frame to hold hay, browse, or whatever your mattress stuff may be. As many sticks as are required are driven firmly into the ground (make holes for them with a pointed stick). Then take willows or other flexible wands, previously suppled by soaking, and weave them in and out from stake to stake as shown in Fig. 64. To keep the outermost stakes from drawing together, cut a strong stick with a fork at one end and a notch cut in the other and set it between the stakes to keep them apart, shoving it higher up as the work progresses.

SLAB CAMPS.—In the mountains round about where I live there are many slab camps made by the native hunters and herdsmen. They last for years, and are welcome shelters for any wanderers who know their location or who chance to come upon them when the weather is bad. Very often the mountaineers go far up into the wilds without blankets or shelter cloths, carrying only their guns, ammunition, frying pan, tin cups, and "some rations in a tow sack." This, too, in freezing weather. But I omitted one thing that they always take along: a full-size axe. Having that indispensable tool, they can get along without tent or bedding, no matter what kind of weather may ensue. From chestnut, basswood, ash, spruce, pine, balsam, or other suitable wood, they split out, with axe and gluts a lot of 9-foot slabs. A stout ridge pole is laid across heavy forked posts or in notches cut in two adjoining trees to which the pole is withed fast. The slabs are laid, overlapping lengthwise, from ridge to ground. A big log fire is kept going all night in front of the shelter. Usually that is all. It must be bitter weather that would urge a southern mountaineer to enclose the sides of such a camp—in his vocabulary there's no such word as "draughts."

A slab camp may be made a very comfortable retreat by taking a little more pains, and it will last unimpaired for years, providing ready-made quarters for future trips. Instead of plain slabs, which let in more or less rainwater, owing to imperfect joining at the laps, use "scoops." These are simply slabs with the flat side hollowed out into shallow troughs or gutters. This is done by cutting a series of cross hacks a few inches apart along the core of the slab from end to end, then, splitting these out by chopping lightly lengthwise of the slab. Having

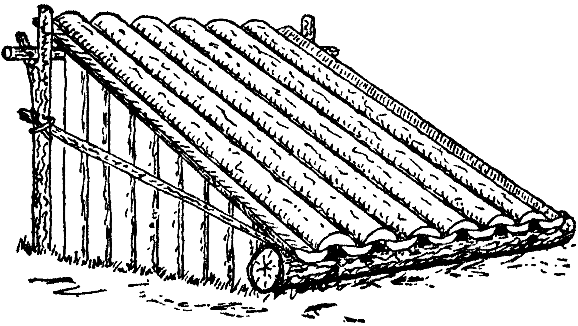


Fig. 65.—Slab Camp

set up your ridge pole, roll a good sized log to form a back for the camp, about seven feet from the ridge, and peg it in position. Lay the scoops overlapping from ridge to log (Fig. 65) and nail them fast, or drive stakes at the rear against ends of scoops. Then enclose the sides with splits or bark, and chink crevices around the log with moss or clay.

The siding may extend to the roof, being trimmed there to proper angle, or may rise little or no higher than the side bar shown in the illustration. The latter plan is best in localities where there are eddying and contrary winds, because it lets smoke out, instead of smoking out the occupants. It is the draught along the ground that chills sleepers, not what comes from above.

In a mountainous region it may be necessary to

build the camp in a hollow between steep ridges. In that case, make it face across the hollow, not up nor down, because the night draughts sweep down a ravine and reverse currents draw up it.

To complete the slab camp, add side logs on the inside, and a foot-log for the bed, the latter being, say, fifteen inches thick, so as to serve as a "deacon's seat." The roof should project far enough in front to shelter the deacon and elders when they are busy holding down the aforesaid log.

Back of this a browse bed, not less than a foot deep; in front, a jolly fire of big logs: then who cares where the mercury may go?

In winter, cover the roof with a layer of evergreen boughs, so that snow shall not melt on it from the heat of the camp-fire. A drift six feet high would only make such a camp the snugger against wind and cold.

Log Camps.—A favorite type of "open faced" camp, is shown in Fig. 66. Logs are laid on top of each other, at sides and rear of camp, to a height of about three feet, being flattened a little so as to make close joints. The back corners may be notched, as in a log house, but it is easier to butt the logs by halving their ends (Fig. 66*A*) and spiking them together. Two stakes are set up in front to hold the ridge pole, and the front ends of the logs are spiked to them. As many rafters as needed are nailed to the ridge pole in front and the top log at the rear. The roof usually is of canvas, but bark or splits may be used by adding cross pieces to hold them. The triangular sides may be enclosed, or left open as smoke vents, bushy boughs being leaned up against the windward side when desired.

The stakes need not be set in the ground, but if it is preferred to do so, the stakes being of green timber, select such poles as are durable in the soil, and roast the sap out of their lower ends until the surface is charred, as this will help keep them from rotting.

In covering such a shelter, put on the siding first

and the roof last, so as to overlap. A two or three-foot overhang sloping downward from the ridge is a desirable addition, to keep rain from driving in. A simple and effective way to rig it is shown by the dotted lines, which represent two forked poles slanting upward from the rear, outside of logs, nailed to logs and posts, and a cross bar laid in the forks to hold the font edge of tarpaulin or whatever else is used as roof. The most comfortable open-air camps that I have made were of this design. There is

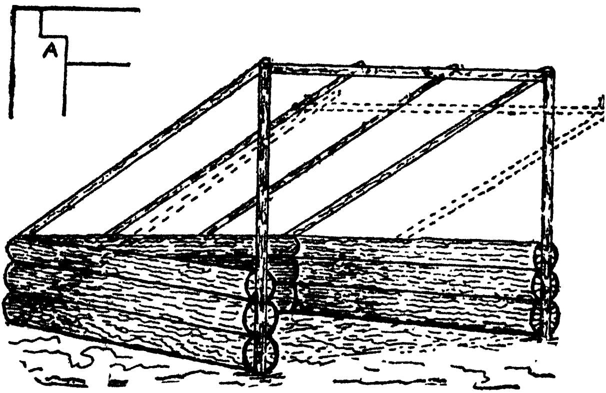


Fig. 66.—Log and Frame Camp

much more room than in a simple lean-to of the same ground dimensions, and heat from the camp-fire is reflected down on the occupants so that they are comfortable in zero weather, yet they have the fresh air of all outdoors.

I prefer such quarters to any tent that ever was made. In summer, the front and sides are easily screened with mosquito netting, a pole on the ground holding the front curtain down. If a little care is used in selecting wood that is durable (see table in Chapter XII) such a camp will last for several seasons, the tarpaulin, of course, being carried along on each trip. For two men and their duffel, a good size is 7 feet high, 7 feet wide, and 9 feet deep, in-

side measurement; for more, merely increase the width.

An excellent camp for a party is arranged by building two such shelters, facing each other, with a log fire between, and a "kitchen" with dining table, benches, and "pantry," at one side, as shown in the ground plan (Fig. 67). The fire is built by laying logs on thick "hand junks," and throws out heat in all directions. In bad, windy weather, the end opposite the kitchen is screened by setting up a row of bushy evergreens close together.

CACHES.—In a camp that is liable to be raided by 'coons, porcupines, or other predatory animals, the meat, fish, butter, lard, etc., should be cached under piles of stones twice as heavy as you think such beasts could move, for they are astonishingly strong and persistent. Bears will demolish any such pile that one man could build.

To cache provisions and other articles in trees: Fasten a strong peeled pole from the fork of one tree to another at fifteen to twenty feet from the ground, wrap up the parcel in canvas or oilskin so snugly that ants cannot get into it, and suspend it from the pole with ropes or wires. The trees should be too slender for a bear to climb, yet too stout for him to shake. The pole is peeled to give less secure footing for small animals, and to make it season into sound wood that will not rot and break. Canvas waterproofed with linseed oil is the best covering, as its odor and taste are offensive to animals of all kinds, great and small. A further precaution, in case of a light parcel, is to make a St. Andrew's cross (X-shaped), hang it from the pole, and suspend the package from the end of one arm of the cross, so that every puff of wind will set it swinging.

A good place for a cache is on an islet in a river or lake, so small that there are not likely to be any predatory animals living on it.

In the North, where wolves and wolverenes must be guarded against, the best cache for meat is made by cutting a hole through the ice of a stream or lake.

fastening the sack of meat to a stick by a rope or hide thong, and letting it down into the water, the stick resting across the orifice. Lumps of ice are then piled into and over the hole, and water is poured on them, which freezes the mass together into a mound a foot or two high. Or a place may

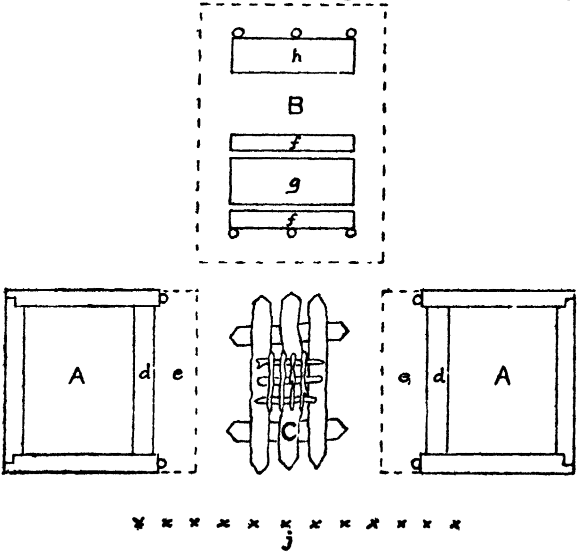


Fig. 67.—Camp Plan
AA—Log Lean-tos; B—Kitchen; C—Camp-fire; dd—Deacon Seats; ee—Overhangs; ff—Benches; g—Table; h—Pantry; j—Wind Screen

be chosen in shoal water where there is no current, a hole broken through, the meat dropped in, and the surface left to freeze over. Warburton Pike says that meat which he cached in this way was found fresh and palatable two months afterward, although the outside was discolored by its long soaking.

On the dry plains and prairies of the West, caches were made in the ground. How these subterranean hiding places were arranged was described by Lewis and Clarke, who, of course, adopted the method of the plains Indians:

"In the high plain on the north side of the Missouri, and 40 yards from a steep bluff, we chose a dry situation; then describing a small circle of about 20 inches diameter, we removed the sod as gently and carefully as possible. The hole is then sunk perpendicularly for a foot deep, or more if the ground be not firm. It is now worked gradually wider as we descend, till at length it becomes six or seven feet deep, shaped nearly like a kettle, or the lower part of a large still, with the bottom somewhat sunk at the center. As the earth is dug, it is handed up on a vessel and carefully laid on a cloth, in which it is carried away, and usually it is thrown into the river, or concealed so as to leave nc trace of it. A floor of three or four inches in thickness is then made of dry sticks, on which is thrown hay, or a hide perfectly dry. The goods, being well aired and dried are laid on this floor, and prevented from touching the wall by other dried sticks, in proportion as the merchandise is stored away. When the hole is nearly full, a skin is laid over the goods, and on this earth is thrown and beaten down until, with the additon of the sod first removed, the whole is on a level with the ground and there remains not the slightest appearance of an excavation."

Even after such precautions, caches sometimes were discovered and dug into by wolves or by Indians' dogs. Another trouble was that they were liable to cave in, if there were no trees with which to timber them. Of course, they had to be situated high enough to be out of reach of river overflows. Still, this method of storing supplies for the future was the best that could be devised in such a situation, and generally it turned out all right. Even such food as dried fish was kept a long time uninjured in underground caches lined with dead grass and hides.

In the far wilderness a cache is considered sacred by all woodsmen, white or red; hence it need not be concealed from prying eyes and itching fingers. But in woods that are frequented by all sorts of vagabonds and ne'er-do-wells, a hiding place for one's supplies must be well chosen to escape the attention of thieves or malicious people. For temporary concealment, a hollow log may do, in case of such articles as cannot be gnawed into by rodents

or entered by insects. Anything that is not injured by dampness can be hidden more securely by digging under an old embedded log, laying it there, covering it up, and restoring the surface to its former appearance.

A secret storehouse for tools, utensils, etc., that you may wish to leave near the camp until next season may be dug in a dry bank and roofed over with logs, brush, and then a layer of earth, like a dug-out, the interior being lined with poles and dry grass, brush, or bark.

Another way, when you have a cabin, is to floor it with split puncheons conspicuously spiked to walls and sleepers. One or two of these puncheons have only spike *heads* driven in the usual places, and are removable. They are fitted with hidden fastenings to keep them firmly in place. This false flooring communicates with a miniature cellar, rock lined, under the middle of the cabin. Boxes are made that can be sealed air-tight (for example, with adhesive plaster). Articles to be stored are thoroughly dried, sealed up in the boxes, on a day when the air is not moist, and the chests are placed in the cellar, resting on flat rocks.

Generally I prefer to build the cache separate from the camp, and hidden at some distance from it. Then, in case the camp is entered by prowlers, or burned out, I will not be minus tools and bedding at the next visit. The cache may be built of rocks under the overhang of a ledge where nobody else is likely to go, or of notched logs with slab roof spiked down, or in other ways, according to circumstances. One will use his wits in utilizing such facilities as the country affords.

Masked Camps.—I have had occasion to locate my lone camp where it would be out of the way of thieves or interlopers, beast or human, as I would be away a good part of the time. Such devices will vary, of course, with the locality one is in. Here are a few general principles to bear in mind.—

The camp is to be situated where not only men but cattle and wild hogs are unlikely to go. There should be nothing in the neighborhood to attract any of the various classes of people who frequent the woods. Study each of these classes in turn, and their habits.

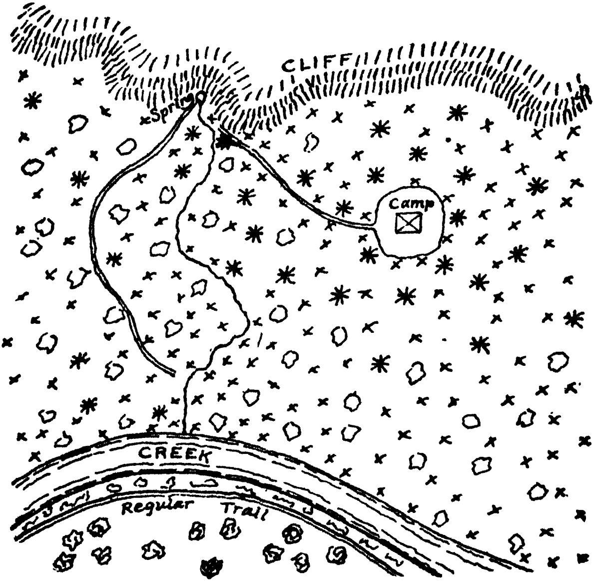


Fig. 68.—A Masked Camp

It should be invisible from trails, and from opposite ridges.

It should be screened by tall trees, preferably evergreens, so that the smoke of a properly fed fire will not betray it by day, nor its light do so at night.

There should be plenty of down-wood in the neighborhood, so that the noise of chopping may be reduced to a minimum.

It should be not far from a regular trail; because you must go back and forth yourself, and if you should make a new trail it soon would attract notice and speculation.

It is impossible for a man, éven though he be alone, to camp more than a day or two in one place without leaving footprints that a woodsman would notice, unless the weather is extremely dry. The problem, then, is to mask the points of ingress and egress.

If your presence in the country is known to low characters, establish a woods alibi, by building another camp away from the real one, but somewhat more public. Build a fire there every day or two, freshen the browse bed now and then, and leave litter and footprints indicating recent occupancy. The more shrewdly this false camp is located the surer you are to lead busybodies to spy after you in the wrong places.

An example of a successful masked camp is illustrated in Fig. 68.

An old trail up the creek is used by herdsmen, hunters, and others going up into the mountains. Fishermen commonly wade the creek itself. On the south side of the stream is a forest mostly of oaks and chestnuts. On the north side is a laurel thicket in which stand numerous birches and hemlocks. To the north is a cliff or steep-sided ridge, at the base of which is a spring.

Neither hogs nor cattle will go over into that laurel thicket when there is an open forest of mast-bearing trees on the other side of the creek, and a regular trail running through it. Consequently nobody looking for his hogs or cattle will cross the stream at this point. Nor is there anything over there to attract game or its pursuers. About the only people who would be likely to go into such a place are timber cruisers, who, of late years, actually count every tree, or blockaders (moonshiners), or spies serving the revenue agents.

If you know those woods, you know how long it has been since its timber was "cruised," and the likelihood of it being gone over for that purpose this year. Anyway, cruisers are decent fellows. The

spring branch and the solitude of that north side would be attractive to blockaders looking for a new location; but if they picked on it, they would erect their still on the branch itself, low enough down from the spring so that they could run water through a spout to the worm of the still. Spies searching for such gentry would go along the branch, and, finding no sign, would waste no more time there.

A man camping in that thicket would have to have some way of getting in and out. It would be much too wearisome to go a new way every time, crawling through the laurel. That means he will make a trail of his own. He leaves the regular trail and steps into the creek not far from a point opposite the mouth of the spring branch, and up that branch he wades a short distance until out of sight of the creek. Here he turns out into the thicket to the left and trims a trail to the spring, starting a few yards back from the branch so that no marks are visible from it. Directly below the spring he starts similarly a trail to the camp site, where he trims out as much space as he needs. Dead trees wind-thrown from the cliff supply him with almost smokeless fuel, and dead laurel, of which there is plenty in every thicket, gives him an abundance of excellent kindling that is really smokeless. When he chops, it will be so early in the morning that nobody else will be within sound of it, for it is an hour's walk, at least, from any house.

Whenever he goes to the spring, or returns from it, he drops a dead laurel bush at the entrance to the side trail leading to camp, the sprangling forks of the bush being thrown outward, which would deter any stranger from pushing through just at that point. The entrance to this side trail, like the one near the mouth of the branch, is "blind"; *i. e.*, not visible from the branch, as you have to part some bushes to find it.

CHAPTER XIV

CABIN BUILDING AND FITTING UP

Nobody knows what solid comfort means until he finds himself, snug and well fed, in a bit of a cabin, far away in the big sticks, while icy blasts rebound from his stanch roof and walls, to go howling away through a famine-stricken wilderness, thwarted by a woodsman's providence and skill.

Open the door: you are face-to-face with misery and death. Close it: the hearth-fire leaps, the kettle sings, you smoke contentedly, and all is well.

A tent, at best, is only a shelter: a cabin is a home. Log walls insure everything within against storms and prowling beasts. There are comfortable bunks for Partner and you, a table, benches and stools or chairs, a cupboard and bins with a good store of food, a chest or two, shelves and racks, a fireplace or stove. The weapons, tools, and utensils are hung just where they are handiest. Plenty of good wood is stacked in the dry. On wet days you can stay indoors without feeling cramped or jailed. And next season, when you come back again, how like an old friend the log hut twinkles welcome!

I shall describe only two types of simple one-room cabins, such as would be built by hunters or others who go pretty far back into the woods and require no more than a snug "home camp." For designs of more elaborate structures, to be used as summer homes in or near "civilization," the reader is referred to Kemp's *Wilderness Homes* (Outing Publishing Co., New York) and Wickes' *Log Cabins* (Forest and Stream Publishing Co., New York).

In the first example I will assume that there is a road or waterway to the camp site on which tools and some materials can be transported by wagon, boat, or raft; also that the cabin is to be large enough for four men, but planned to economize time and labor in construction, so that it may be finished in a week. You are supposed to hire a man with team to snake the logs in, unless enough suitable trees grow on the site itself.

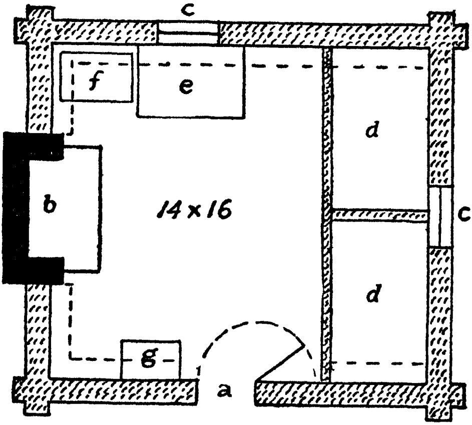


Fig. 69.—Log cabin (ground plan) a—door; b—fireplace, 4′; c, c—windows; d, d—bunks, $4\frac{1}{2}$x$6\frac{3}{4}$′; e—table, 3x$4\frac{1}{2}$′; f—grub chest, 2′x3′; g—wash stand, $1\frac{1}{2}$′x$2\frac{1}{2}$′; straight dotted lines indicate high shelves

Decide beforehand what kind of roof you shall make. If it be of sawed shingles, or of roofing felt, then you must take along roof-boards as a foundation for them. A roof made simply of planks battened and painted will last several years without any covering, and it is easiest of all to build; but it is prone to warp or cup, under a summer sun, and then leak.

If roofing felt is used, carry along paint and brush to take the black "curse" off. Clapboards riven from neighboring trees are chosen in the present instance,

as other methods of roofing are familiar to everybody. They call for no roof-boards, being nailed directly to the stringers (rafters that run parallel with the ridge). The way to make them has been described in Chapter XII.

A stone chimney, with fireplace not less than four feet wide, is ideal for heating a woodland home. Nothing is so jolly as an open fire of hardwood logs. With a Dutch oven or reflector, besides the ordinary utensils (see Vol. I., pp. 65-66), you can cook as well on the hearth and over the fire as in a stove. But if rocks are scarce about your building site, or if good fuel is not abundant, a stove will be required. It will save a good deal of labor in building, and much wood chopping thereafter. Choose for yourself.

Let us say that you decide on a clapboard roof and a stone chimney, the house to be 14 x 16 feet inside measurement, high enough for a porch in front and a lean-to kitchen in the rear, to be added in future. A ground plan is shown in Fig. 69. It may be modified, of course, according to frontage and other conditions.

The tools you ought to have for such a job are:

2 Axes,	Jack plane,
2 Hatchets,	Framing chisel (1-½),
Crosscut saw (6 ft.) and handles,	Tape line,
Peavey, or cant hook,	2 ft. Rule,
Sledge hammer (8 lb),	Steel square,
2 Steel wedges (5 lb.),	Pocket level to screw on square,
Froe,	T-bevel,
Spade,	Plumb-bob,
Mattock,	Chalk line and chalk,
Hand saw,	Crosscut saw file,
Rip saw,	2 Triangular files (7 in. and 6 in. slim taper),
Compass saw,	Mill file (8 in.),
Brace,	Whetstone,
3 Auger bits (⅜, ¾, 1¼),	50 ft. Rope (1 in.).
2 Drill bits (⅛, ¼),	
Drawing knife,	

I have helped to build two clapboard-roofed cabins with fewer tools than these, but the others would have come in handy. We had no need for any not mentioned on this list. Some of these are used only in making furniture. All of the light tools except the square go in a carpenter's shoulder chest. The crosscut saw should be tied between two thin boards, as shipped from the factory.

Materials to be "carried in" are 1¼-in. planks for flooring, dressed on one side; ⅞-in. planks, dressed on both sides, for door, casings, shutters, furniture, and shelving; 2 glazed window sashes, single; wire nails (40d, 10d, 6d), wrought nails for door and hinges; strap hinges for door and cupboard and chests; door-lock; 2 flat steel bars for fireplace lintel; round steel rod for "crane" in fireplace; heavy wire for pot-hooks. A screen door, and wire screen cloth for windows, will add greatly to comfort.

Site.—Build where there is good natural drainage, and below a spring, or near some other source of water supply that is beyond suspicion. Cut away all trees that would shade the cabin except from the afternoon sun. Forest air is nearly always damp, and you need plenty of sunshine up to the noon hour. If you are in an original forest of tall trees, bear in mind that such do not root nearly so firmly as trees growing alone in exposed positions. When a tree of the ancient forest is left standing by itself in a clearing, it is easily overthrown by wind; so do not leave one of these near enough to the house that it might crush your cabin.

The features of good and bad sites are discussed in Vol. I., pp. 208-214.

Do not dig a cellar under the house. A cellar not cemented is a trap for water, especially when the snow begins to melt. A small cache may be dug under the center of the floor, where it will stay dry

TIMBER.—The logs should be straight and of slight taper, the best of the smaller ones being reserved for floor and roof timbers. Those for the sills should be at least a foot thick, but the upper courses may be smaller. The wood must be of some species that is light and easy to work. Choice will depend, of course, upon what is available. The best common woods are the soft pines, spruce, and young chestnut. Sills should be of wood that is stiff and durable (see tables in Chapter XII). They may be cut long enough to support the porch, if one is to be built. Tall, straight, slender trees are common among the younger growth wherever the stand of timber is dense.

Logs are best cut in spring or early summer, as the bark then can be peeled with ease. If it is left on, it soon begins to loosen, moisture and insects get under it, and decay sets in. Pine logs, even after they are peeled, are attacked by "sawyers" (wood-boring larvæ of beetles) which advertise their work by a creaking sound and by wood-dust dropped from their borings. They work just under the surface, in a girdling way, do no serious damage, and cease operations after the first season.

Cut the wall logs about three feet longer than the inside dimensions of the room, so as to allow eighteen inches at each end for jointing, unless you adopt one of the ways of building without notches to be described hereafter. I have already told how to select good board trees for the roofing.

CORNERS.—If the building site happens to be of sand or gravel, and is flat, the sills may be laid directly on the ground; but if the place is not level, or if there is soil on the surface, you should set them up on piers or posts.

Stake out the corners, and square them by the method shown in Fig 18. At each corner set up either a pier of flat rocks or a heavy post.

These should go down in the ground below frost-line, and project just enough to keep the sills off the ground all the way round. Lay the two sills and level them by hewing out underneath or blocking up, and testing with the level on your square. To make a good job of this, rip out two boards about six inches wide, nail them together for a straight-edge reaching from one corner to another diagonally opposite, and use your level on the center of the straight-edge, where it is most likely to sag. When the sills are level and squared, block them up near the center of each with rocks, to keep them from springing and sagging. The tops of the sills and floor joists are to be scored and hewn flat.

After laying the sills, dig down at the chimney end to a solid base and lay a rock foundation for chimney and hearth (Fig. 76*d*), the latter to project about two feet inward from front of fireplace. Make corbels or some other arrangement for inner ends of floor joists to rest on where they meet this foundation.

Locking Corners.—Wall logs usually are locked together at the corners by notching. There are several ways of doing this. The quickest is the saddle notch (Fig. 70) which has a wedge-shaped cut on top of lower log and a V-notch in bottom of the one that rides on it. This work is done by eye alone, and calls for expert axemen.

Another is the rounded notch (Fig. 71) cut nearly half-way through on under side of log. It takes some trouble to round out the notch, but a neat fit results. There might be a shallower rounded notch cut on both top and bottom of each log, to make the logs lie close together; but the upper one would collect moisture and then decay would set in.

A third way is to saw and split out one-fourth the diameter on each side of the end (Fig. 72),

leaving the center like a tenon, and spike the ends together. This makes close joints, and shorter logs are used, as the ends do not project. It is best adapted to poles of six-inch diameter and under, which do not require large spikes.

Fig. 70.—Saddle notch

Fig. 71.—Round notch

A very good way, especially for amateurs, is to saw the logs to exact dimensions of *interior* of room designed, and spike the ends to an L-shaped "trough" of heavy plank (Fig. 73) which, when set on end, will reach to the height of the walls. First lay the four bottom logs, and spike the troughs upright

Fig. 72.—Tenon-shaped end

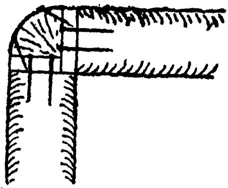


Fig. 73.—"Trough" corner

to the corners, having, of course, plumbed and braced them in position. Then proceed similarly with the other logs until walls are finished. This makes close joints that require little chinking, if the logs are straight. Finish the open corners by quartering a large log, or hewing four small ones, cut to height of walls, and nailing them to the troughs as shown. This is easier and quicker than notching. If you choose this plan, take along some 2-inch plank for the troughs, as thinner stuff is not stiff or strong enough; also some 60d nails or spikes.

Joists and Walls.—Having fitted cross logs to the sills, test again to insure that all is square. Then fit the ends of the joists into gains chiseled out of the sills (Fig. 74). The logs for joists

should be fully eight inches thick, or they will be too springy. They may be spaced about two feet apart from center to center. Different thicknesses can be allowed for in shaping them to the gains, so that all may be level.

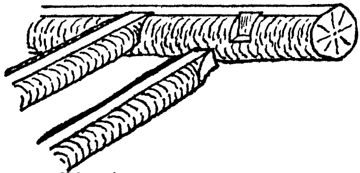


Fig. 74.—Fitting joists

Now go ahead with the walls. Lay the logs with butts and small ends alternating, so the walls may go up of even height. To raise the logs, as the work advances, lean two poles against the wall as skids. Near each end of the top log fasten a rope, pass the free ends of the ropes under and over the log to be lifted, and up to the corner men, who pull on these while other men push from below.

At the height of windows, door and fireplace, make saw cuts almost through the upper log, in each case, at proper distance apart, so that afterward the crosscut blade can be pushed through and the spaces sawed out.

Roof.—For a clapboard roof the stringers or rafters run lengthwise of the cabin instead of from eaves to ridge (Fig. 75). The gables are built of logs notched for the stringers, spiked together, and cut to the proper pitch. Select straight, slender poles for stringers. The ridge pole should be heavier: say 8 or 10 inches thick.

The pitch of the roof will depend upon climatic conditions; rather flat for a dry region, and steeper for a wet one (not less than one foot rise to two of width for main building, and one to four for porch and kitchen). If there are heavy snowfalls, a steep

pitch is required to stand the strain, and to keep snow-water from backing up under the shingles.

In laying the roof, begin at the eaves, letting several inches overhang. The clapboards should also project a little at the sides of the roof. When the first course is laid, take the straight-edge that

Fig. 75.—Log cabin (end view)

you used for leveling the sills and nail it lightly on top of this course as a guide for the next to butt against. Then lay the second course, breaking joints carefully; and so on to the top. If you finish the ridge with a saddle-board (inverted trough to shed water from the joint), or a log hewed out to serve as such, then the clapboards are sawed off to fit. Otherwise, let the top course on one side project, slanting upward over the other (this is not a reliable device for a very windy or snowy climate).

Floor.—In laying the floor, leave an open space in front of fireplace for the hearth. As the joists will shrink in seasoning, it is wise to use as few nails as practicable (only at ends of boards). Next year the planks may be taken up to be refitted where they have gaped apart, blocked up where the joists have sagged, driven tight together by an extra strip, and then nailed permanently in place.

Door and Windows.—Before sawing out the door space, tack a plank vertically on each side as a guide, and block or wedge the logs so they cannot

sag when cut through. Remove one handle from your crosscut saw, push the blade through the cut that you made when building the wall, attach handle again, and saw out. Snap a chalk-line along the log that comes directly over the doorway, and chisel out a section three or four inches deep for top of door frame to be nailed to. Spike the jambs to ends of abutting logs. Fit in a washboard beveled on both sides.

The door should swing inward; otherwise, if the cabin is occupied in winter, you may find your egress blocked by a snow-drift.

If you can bring in a screen door, by all means do so. In such case you may as well bring also a ready-made door and casing. If means of transportation do not permit this, then make a simple batten door. Use wrought nails, as they can be clinched more neatly and firmly than wire ones.

To hang a door: Place it exactly in position (shut) with bottom and sides wedged to give proper clearance. Set the top hinge so that its pin is just in line with crack between door and jamb, and nail it; so also with the lower one. Fit the lock, or make a wooden latch and attach hasp and padlock.

The windows, being only single sashes, may be hinged to their casings, like the door, or fitted on slides (Fig. 78). Shutters should be provided to close the openings when the cabin is left unoccupied. They may be fitted to bolt from the inside.

There may well be a third window in our design, alongside the door and over the washstand. If a kitchen is added, the rear window space will be sawed down for a doorway.

CHIMNEY.—Saw out of the end wall a space for the chimney, just as you did for the doorway. The opening between wing walls of fireplace should be about 4 feet wide, 18 inches deep, and 3 feet high. The sides of fireplaces often are built nar-

row within and flaring outward, so as to help throw the heat out into the room. This is well enough where fuel must be economized; but in the big forest, where there is abundance, it is best to build the fireplace with straight sides, so that backlogs of nearly 4-foot length can be used. This saves a lot of chopping.

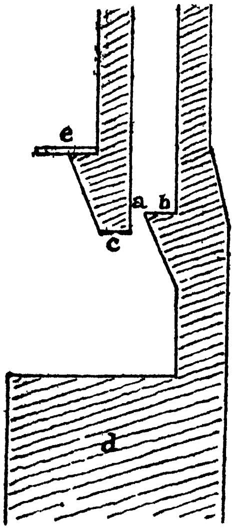


Fig. 76.—Fireplace (vertical section)

If the back of the fireplace is built up straight into the flue, the chimney is very likely to smoke whenever the air is heavy or the winds contrary. To insure a good draught, build the upper part of the fireback with a forward slope, as shown in Fig. 76, forming a "throat" (*a*) about 5 inches *above* the front of arch or lintels and only 3 or 4 inches deep. The top of this throat forms a ledge (*b*) that checks wind from rushing down the flue.

To support the rocks over the fireplace, instead of building an arch (which is likely to crack or give way from settling of chimney) set in two flat steel bars, 2½ x ¼ inch, as lintels (*c*).

Build the wing walls of the fireplace out into the cabin far enough to protect the ends of abutting logs, and to support a plank or puncheon for mantelshelf (*e*). The upper part of the chimney goes quite outside the cabin, and so requires no flashings.

In backwoods cabins the chimneys generally are built up without mortar, clay being used instead. As clay shrinks and loosens in drying, such a structure must be chinked over again at intervals. It is more satisfactory to take in with you a sack of

cement, if possible, and use around the joints of fireplace and hearth a mixture of one part cement to two of clean sand. Mix only a little at a time, as it soon sets. However, this may be deferred until the second season, by which time the chimney is likely to have settled and opened the joints here and there.

Wherever there is limestone, enough lime for mortar can be made without much trouble, by a process similar to that of burning charcoal. Enclose a circular space of 5 feet diameter by a rude stone wall 3 feet high; cover the bottom of this enclosure with brush to facilitate kindling the kiln; then fill with alternate layers of dry hardwood and limestone broken into moderate-sized pieces, piling the top into conical form. Light the pile, and when it is well going, cover the top with sods to make the calcination slow and regular. Keep it going for two days and nights. Lime can also be made from mussel shells or oyster shells. Slake the lime in a box some days before it is to be used, and cover with sand.

For mortar, work the lime into a paste with water and mix in with this, thoroughly, from 2½ to 3 parts of sand. Thin with water until it mixes easily.

A pretty good substitute for mortar is blue clay (yellow will do) mixed intimately with wet sand. Another is a mixture of sand, salt, and wood ashes.

When laying a chimney or wall, see that no joint comes over or close to another joint. If a rock does not fit, turn it over and try again.

At the proper height in your fireplace (a little below level of lintels) insert a stout steel rod horizontally on which to hang wire pot-hooks when cooking. In place of andirons, select two rocks about 15 x 5 x 5 inches, to support the "fire irons" for frying-pan, etc. (See Vol. I, p. 64.) Never

lay backlogs on them: they are only to be used when cooking, or to hold forestick in place.

CHINKING.—If there are large crevices between the logs they should be filled with quartered poles. Small ones are caulked with moss or clay. Mortar should never be used for this purpose until the logs have seasoned thoroughly and got their "set."

FITTINGS.—In Fig. 69, a pair of pole bunks are shown (*d, d*) across the end of the room opposite the fireplace, where they are least in the way. They are to be built high enough to store personal chests under. A high window at *c* lets in the morning light. Each bunk is roomy enough for two persons.

The table (*e*) is movable. The provision chest (*f*) may be lined with zinc to keep out rodents, although wire screen cloth is effective and easier to apply. It serves as a bin for flour, potatoes, etc. Over it hangs a cupboard for dishes and minor foodstuffs.

Dotted lines show high shelves around three sides of the room. At *g* is a stand for water pail and basin, with towel and mirror above and slop pail underneath. Dry wood is piled in the corner between this and the fireplace. A broom is hung behind the door. Chairs or stools go where most convenient at the time.

AXEMAN'S CABIN.—It is quite practicable to build a small cabin with no other tool than the axe, and out of no other materials than such as grow on or around the site. This often is done in remote forests where there is no road. In such case the shack is no larger than actually necessary—say 8 x 10 feet, or at most 10 x 12.

The roof may be of bark (see Chapters XII and XIII) held down by weight-poles running from ridge to eaves and tied together in pairs at the top to keep them from slipping down. However, a bark roof is flimsy. A much better arrangement is to "carry in" a ready-made paulin of 12-oz. canvas,

which can be bought of a tent maker or a mail order house, a can of paint, and a brush (or the paulin may be waterproofed before starting—see Vol. I., p. 72), and tack this to the rafters. Thus a durable and perfectly reliable roof is quickly made.

These small shacks are best heated by a folding stove of sheet iron, which can be carried in on a man's back. Take along, also, a collar for the pipe.

When there are only one or two men to do the work, the house may have to be built of poles. In such case I prefer a shed-roof construction, as it takes less material and is easier erected than one with a ridge. But if there are trees that split easily, it is better to build of logs split through the center. These half-logs are easy to handle, easy to notch and lock at the corners, make close joints and require little chinking; besides, since the walls are flat inside, there is less waste of space and material. It is not necessary to floor such a shack. Some use poles for the purpose; but a pole floor is hard to keep clean and offers harborage for vermin. A hard-trodden earthen floor is easy to sweep and can be kept quite neat. It is warmer than an ill-fitting one of boards or puncheons.

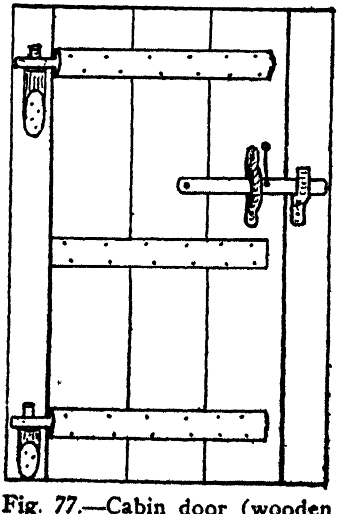


Fig. 77.—Cabin door (wooden hinges and latch)

The door can be made of boards riven with axe and wooden wedges, with wooden hinges and latch,

as in Fig. 77. The hinge pins are made of cuts from a sapling, slightly flattened on the inner side and with tops whittled to fit holes in flattened ends of top and bottom door battens, which are half-round. The latch guard and catch are of naturally bent branches or roots, or may be whittled out. The end of latch string that hangs outside is knotted so it cannot pull through the hole.

Cabin windows, when glass is unobtainable, may be made of translucent parchment (recipes in Chapter XVII), but it is better to carry in with the outfit a sheet or two of transparent celluloid, such as is employed for automobile curtain windows. Lacking all such materials, cut out a window space, anyway, that can be left open in fair weather and closed with split boards at other times.

Rustic Furniture.—Boards riven like clapboards from green timber are likely to warp in seasoning unless stacked carefully, or held in forms

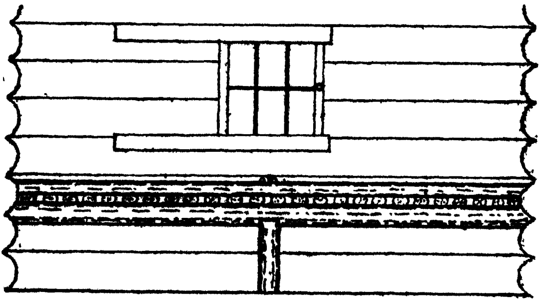


Fig. 78.—Pole bunk (for four men)

until they have dried through. If only one flat side is required, as in shelving, seats of stools and benches and so forth, split a small log in two and hew the flat side smooth. A number of these joined side by side, and cleated on the under side, will serve very well for a table top or other broad surface.

The bunk (Fig. 78), for four men, is made by running a pair of straight poles about $4\frac{1}{2}$ feet apart, from side to side of cabin, fitting the ends

in the joints between wall logs, and supporting the middle on posts. Athwart these are laid small poles to support the mattresses and on top of them, directly over the large poles, are fastened two other long poles as guards. The mattresses are simple bed ticks filled with fine browse or whatever other soft stuff is available. It pays to take ticks along, as they hold the stuff in place and are easy to refill.

Double berths, one above the other, are nuisances in every way. Folding cots are more cleanly than any kind of fixed berths, and they can be carried out of the house to sun and air while the floor is being swept.

The table (Fig. 79) has no rounds nor braces at the bottom, which would be in the way when people

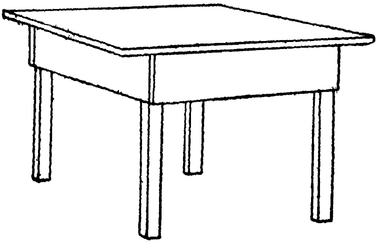


Fig. 79.—Table

were seated at dinner. The legs may be made of four pieces of sapling squared for nailing cleats at the top, and the lower parts may then be shaved round or tapered. Make the table 30 inches high.

The washstand is simply a broad shelf attached to a cleat on the cabin wall and supported further by brackets or diagonal braces, leaving the space underneath clear.

Regular chairs should not be made until proper

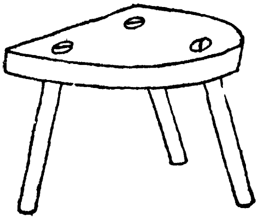


Fig. 80.—Stool

wood has been thoroughly seasoned for this purpose. If it is to be used with the bark on it must be cut in mid-winter. Meantime the occupants of the cabin can use stools (Fig. 80) and benches (Fig. 81) made of green wood by splitting out slabs and fitting natural round sticks in auger holes for legs, wedging these in like an axe helve so they can be refitted when the wood has shrunk in seasoning.

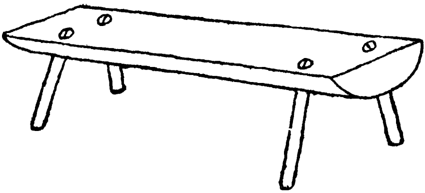


Fig. 81.—Bench

An easy chair is readily made, as shown in Fig. 82, by using a piece of canvas for seat and back.

Split-bottom chairs (Fig. 83) are particularly appropriate in a log cabin. Those common in the backwoods are generally made stumpy (only 16 inches high in front and 15 in the rear). It is better to make them 18 inches to top of seat, so they will be right for a 30-inch height of table. In making them you will need a drawing knife, a ¾-in.

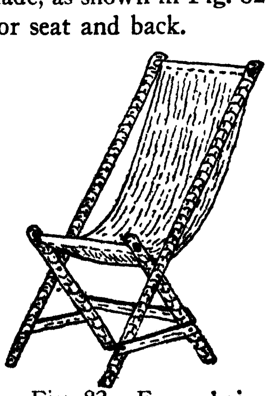


Fig. 82.—Easy chair

bit and ¼-in. chisel to mortise slots for the three broad splits that connect the back posts (round sticks may be used instead of splits). A 60-cent hollow auger, commonly used for making tenons, is better than a spoke sizer to fit the ends of rounds to their holes. Besides gluing these ends, you can fox-wedge them (Fig. 84) in place by splitting each end a little and inserting a thin wedge before driving home.

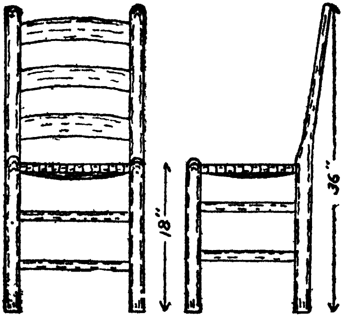


Fig. 83.—Split-bottom chair

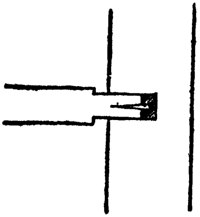


Fig. 84.—Fox-wedge

To fill the chair seat, use oak or other splits (see Chapter XIII) in the manner shown in Fig. 85. Cut the end of a split narrow enough to tie easily around the side bar at *a*. Then run it across and pass it under and back over the opposite bar, and so on, as the cut shows. When you get to the end of this split, tie another to it, keeping knots on under side of chair where they will not show. When the seat is filled up with the strips going one way, fasten the end, beginning at rear (*b*), and run others crosswise, in and out, until the seat is finished.

Instead of the plain pattern shown in this example, it is better to weave a diagonal one similar to that in the back of the rocking chair (Fig. 86). To do this, run the strands as follows:

1. Over two, under two, etc.
2. Under one, over two, under two, etc.
3. Under two, over two, etc.
4. Over one, under two, over two, etc.

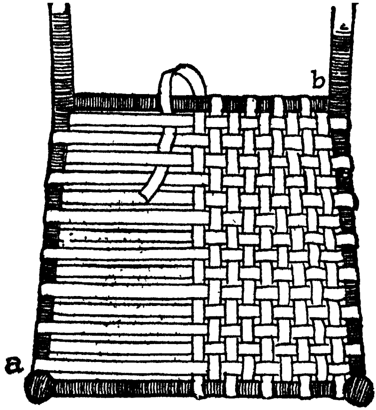


Fig. 85.—Bottoming chair with splits

Repeat in above order. Be sure to draw the split as tightly as you can every time it crosses the chair.

Raw deerskin, or other animal pelt, makes good chair seats.

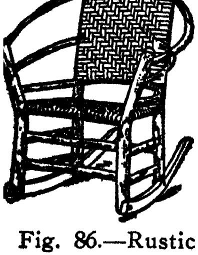


Fig. 86.—Rustic rocker

Racks for guns, clothing, etc., are easily provided by cutting crotches of small limbs and nailing them up in convenient places. Wooden pins set in auger holes in the walls may be used for similar purposes. If you have no auger, a hardwood pin can be driven into a soft-wood log by trimming its point wedge-shape and starting it in a nick made with the corner of the axe blade.

Outside, under the projecting roof at a gable end,

fix a rack on which full-rigged fishing rods may be stood during the day (of course, you will unjoint them and take them in at night). This rack consists simply of a small shelf for the butts, and, high up a narrow shelf with auger holes bored close to the edge and a narrow slot cut out from each hole to the edge for a rod tip to slip through.

The first essential of good housekeeping is a broom. Tie together a round bundle of thin birch, willow, or other flexible twigs. Cut a broomstick, sharpen one end, and drive this pointed end into the center of the bunch—then it will hold fast.

Some rainy day you can make a really first-class broom from birch splints. Select a straight yellow birch five inches in diameter and cut off a six-foot length. At about fourteen inches from the big end cut a ring around the bark about two inches wide. Peel off all the bark below that ring. Then, working with a sharp jackknife, split small flat slivers from the butt end up to the bark ring. Continue until there is nothing left of the butt save a small core at the top, and cut this off carefully. Then remove the bark above the ring and sliver the wood down until there is only enough left for a broom-handle. Tie this last lot of slivers tightly down over the others with a stout string. Trim off the slivers evenly. Then whittle off the handle, smooth it with glass, make a hole in its top and insert a hide loop to hang it up by. This is the famous splint broom of our foremothers, as described by Miss Earle in her *Home Life in Colonial Days.*

Don't crowd the cabin with decorations or "conveniences" that will be in the way and serve chiefly to collect dust and cobwebs. Let each and every article have a definite purpose, and show it by its perfect adaptability. The simplest contrivances generally are the best.

CHAPTER XV

BARK UTENSILS—BAST ROPES AND TWINE—ROOT AND VINE CORDAGE—WITHES AND SPLITS

Among the many interesting woodsmen that I have known was one who, years agone, had lived a long time alone in the forest, not far from where Daniel Boone's last cabin was built, in what is now St. Charles County, Missouri. I call him a woodsman, because he had to be, and loved to be, a real one; but beyond that he was a scholar. In his young manhood he took to the woods that he might gain first-hand knowledge of Nature, and have leisure for a colossal labor of love: that of translating into English, with his own exegesis, the works of the philosopher Hegel. When the Civil War broke out, this hermit abandoned his cabin and raised a body of volunteers to defend the Union. Afterward he became Lieutenant Governor of his State.

One day we were discussing those traits of our old-time frontiersmen that made them irresistible as conquerors of the West. The Colonel named, as one factor, their extraordinary shiftiness in shaping the simplest or most unlikely means to important ends, and he illustrated it with an anecdote.

"I knew an old man of the Leatherstocking type who once was far away and alone in the wilderness, hunting and trapping, when the mainspring of his flint-lock rifle broke. Now what do you suppose he did?"

"Made a new one out of an odd bit of steel."

"No, sir: he had no bit of steel."

"Then of seasoned hickory or *bois d'arc.*"

"No room for it in the lock. The old man had killed a turkey. He split several quills of its pinions, overlaid them one on another, bound them together with wet sinews that shrunk when they dried, and —there was his mainspring. It worked."

BOILING WATER IN A BARK KETTLE.—A competent woodsman can cook good meals without any utensils except what he makes on the spot from materials that lie around him, and he will waste no time at it. In the chapters on *Camp Cookery** I have shown how to broil, grill, roast, bake, barbecue, plank and steam without utensils. But, it may be asked, how would one *boil water* without a metal kettle? There is more than one way of doing this.

One of them, which many have read of, but few nowadays have seen, is to split a short log, chop out of it a trough, pour water in, heat a number of small round stones to a white heat, pick up one with a forked stick or extemporized tongs, drop it into the water, add another, and so on until the water boils, which will be very soon. To keep it boiling, remove the stones and add others from the fire. You must select such stones as will neither burst in the fire nor, like sandstone, shiver to pieces when dropped in the water.

Another way, which will be news to many, is to boil the water in a bark kettle by direct action of the fire. The thin inner bark of many species of trees will do, or a thin sheet of the bark of the paper birch, notwithstanding that it is so notoriously inflammable that we use it for kindling. No, this is not a trick; it is a practical expedient.

But first you must know how to make a watertight vessel out of nothing but a square sheet of pliable bark and a couple of thorns or splinters. Seems

*See Vol. I., pp. 293-299, 301, 309, 312, 315, 317, 319, 322-324, 330. 344-346, 352, 369.

impossible? Nay, very simple. Try it at home with a sheet of writing paper. Cut out a 12-inch square (or smaller—I give dimensions for a real bark kettle in which to boil a quart or more of

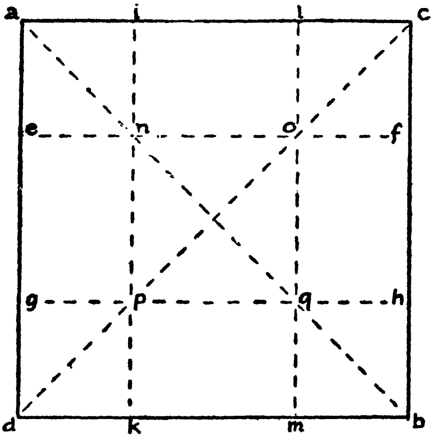


Fig. 87.—Folds for water tight vessel

water). Note the diagram (Fig. 87). Fold over from *d* to *c* making the points of triangle meet at *a*. Open up, and fold similarly from *a* to *b*. Open again, and you have the diagonal creases *ab* and *dc*. Turn the sheet over, and fold from *ad* along the line *ik*, which is to be 3½ inches from the margin. Similarly fold *cb*, *db*, and *ac*. You now have made all creases as in the figure. They are your guides in making a neat job.

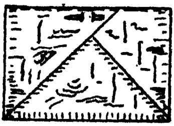


Fig. 88.—
Bark kettle
(end)

Grasp the point *i* with one hand and *e* with the other, raise them, and bring them together: This throws *a* outward at an angle. Fold *a* over to right on the outside, and hold it there. Do the same at the corner *c*. These two corners now will overlap on the outside, as in Fig. 88. Fasten them with

a pin (with a splinter like a skewer, if you are using bark). In the same way fold the corners *d* and *b*, and pin them. The creases *no, pq, np, oq,* now are folded inward, instead of outward as they were originally. Here you have an open-top box 5 inches square and 3½ inches deep, with perfectly tight joints, which will hold water so long as it does not seep through the pores of the paper (would hold it till it evaporated, if you had used bark).

Now, if you are skeptical about boiling water in a bark kettle, suppose you try your paper one. Arrange a stand that will support it over a gas jet. Put the paper kettle on the stand and pour some water into it. Light the gas, raising the jet just high enough for it to play on the bottom of the vessel but not up the sides; for, mark you, if the flame touches the paper *anywhere above the water-line,* it will set the thing afire. Observing this precaution, you can boil water in the paper kettle quicker than you could in tin.

The reason that the paper is not even scorched is that the water inside instantly attracts the heat of the flame and absorbs it to itself. My partner, Bob, once told me he could take a boiling tea-kettle from the stove, put his naked hand on the bottom, and hold the thing out at arm's length. I smiled. He led the way to the kitchen, where an old-fashioned black kettle of cast-iron was steaming at a hard boil, did as he had offered, and sustained no injury whatever. Then I did it myself. The bottom of the kettle merely feels warm to the naked hand. But the water must be boiling, not just simmering. If one touches the vessel above the water-line, he will get a severe burn.

In making a bark kettle, the material must, of course, be quite free from holes or cracks. In the case of birch, select a sheet free from "eyes" and surface "curls." Supple it by roasting gently over the fire.

I have boiled water in such a vessel by setting it directly on the coals, and covering all around its bottom with ashes, so no flame could reach the sides. For your first trial it will be better to build a little circular fireplace of stones, with a draught hole at the bottom, and cover the top with flat rocks, leaving an opening of about three inches diameter for the bottom of your kettle. Fill this with live coals, and chink with mud, so that no flame can get out.

It might seem impossible to *melt snow* in such a bark utensil, but the thing can be done when you know how. Place the kettle in the snow before the fire, so it will not warp from the heat. In front of it set a number of little forked sticks, slanting backward over the kettle, and on each fork place a snowball. Thus let the snowballs melt into the kettle until the vessel is filled as nearly as you want it. Then set the kettle on the coals, cover around it with ashes to keep flame from the sides, and the water will boil in a few minutes.

BARK UTENSILS.—Vessels to hold water or other liquids can be made, as above, of any size, square or

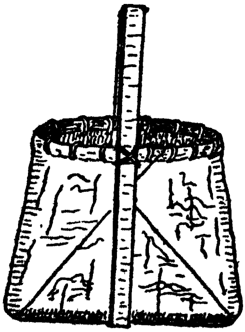


Fig. 89.—Bark water bucket

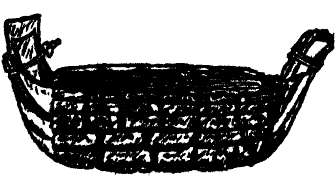


Fig. 90.—Bark trough or basin

rectangular. You soon will learn the trick of folding the corners without preliminary folding and creasing. Since the top of a cubical bark vessel

of this sort readily adapts itself to a circular shape, when softened by heating, one can make a water bucket, for example, by sewing a hoop or splint (like a basket splint) around the inside of the top edge, and adding another vertically for bail, like a basket handle, going clear around the bottom to take up

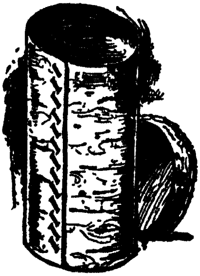


Fig. 91.—Bark barrel

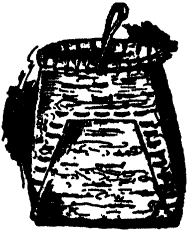


Fig. 92.—Bark berry pail

the strain (Fig. 89). Punch the holes with a sharpened twig for awl, and use rootlets or bast fiber, soaked in water, for thread, or lace the loop in place with narrow strips of pliable bark.

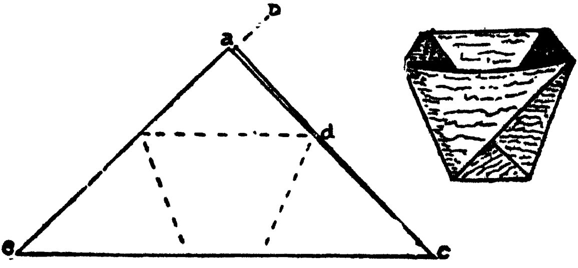


Fig. 93.—Pocket cup (folding)

Wash basins and the like are made in the same way, shallow without bails. A trough or tub, of any size, to hold liquids, is quickly made by rossing off the thick outer bark from the ends of a sheet of elm, basswood, poplar, cottonwood, or other suitable

material, but leaving it on the middle part to stiffen the vessel; the rossed ends are then folded over in several overlaying laps, gathered in somewhat the shape of a canoe's bow and stern, and tied with bark straps (Fig. 90). The Indians used to make such tioughs for collecting maple sap. They also made elm barrels (Fig. 91) that would last for years. Their bark buckets often were made with lapped seams, sewed together with bark or root twine (Fig. 92). The seams were closed with a mixture of pine resin or spruce "gum" and grease or oil, laid on while hot, and the upper edges were stiffened with hoops or splints of pliable wood.

To make a folding bark cup for the pocket: take a sheet of thin bark about 7 inches square and fold it diagonally (*a* to *b*, Fig. 93). Now fold the corner *c* over to the left so that its upper edge coincides with the dotted line that extends horizontally from *d*. Then fold, over this, the corner *e* straight to *d*. This leaves two triangular flaps standing out at the top, *a* and *b*. Slip the inner one, *a* into the outer pocket formed by *e*, and fold the flap *b* backward over the outside. You now have a flat cup that holds about a quarter of a pint. To open it, press against the outer edges with the thumb and finger. When carrying it in your pocket, slip the flap *b* in along with *a*, and the cup is closed against dirt.

A bark dipper is easily made. Take a sheet about 8 x 10 inches. trim it to spade shape (Fig. 94), fold it lengthwise from *A* to *B*, open it out, place the second finger behind *A*, and make the fold upward as shown at *F*. Cut a stick for handle, with stub of a fork at one end to hang it up by. Split the other end of the stick, insert *F* in the cleft, and bind it fast with a narrow strap of bark.

A strong and durable tray, dish pan, or similar utensil, is made like Fig 90, with the addition of a hickory or other rim like that of Fig. 92, sewed on

the outside. Leave the thick bark on the sides to stiffen them, but shave it off of the bottom, so that the vessel will stand upright.

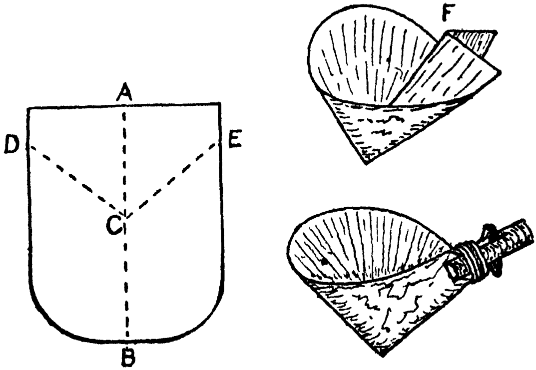


Fig. 94.—Bark dipper

Bark Fish Buckets and Corseaux.—Every trout fisherman knows how bothersome a willow creel is when he is fishing the brushy head waters of a stream. And a creel is a nuisance not to be thought of when one is off on a hiking trip. A canvas bag, with or without rubber lining, is compact enough, but it is mussy and does not keep the fish in good order. To carry trout on a stringer is

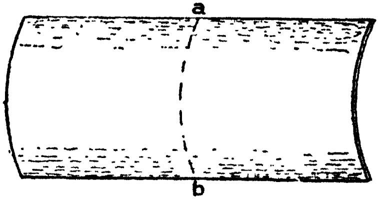


Fig. 95. Fold for fish bucket

barbarism. So, look for a young basswood, or poplar, or other smooth-barked tree that will peel. It need not be more than 9 or 10 inches thick. Strip from it a rectangular sheet about 12 x 22 inches.

Also cut a bark carrying strap about 4½ feet long, and a quite narrow one for thongs.

Fold the sheet of bark across the middle of the longer dimensions (*a--b*, Fig. 95), and bring the ends together, one overlapping the other. The natural convexity of the bark spreads it out into an oval at the top. If the bucket were to be used for berry picking, or the like, you would fasten the top by merely cutting holes through at *A*, Fig. 96, and the corresponding point on the opposite side, and tying with bark thongs. For a fish basket, the thong is strung crisscross as shown in the illustration, as this keeps the fish from flopping out. Attach a bark shoulder strap through slits in the back, and the thing is done. You have a sweet, clean "bucket" that carries under the left arm without bulging so much as a creel, and no top is needed. Put clean ferns or grass over the fish when the sun is hot, and they will keep moist and firm and well-colored, all day. This bucket is easier to wash than a creel. In a week, if you are to stay longer, make a new one, as the old one will have warped.

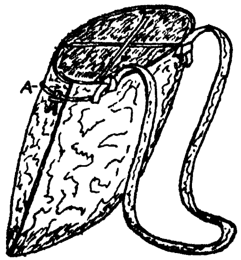


Fig. 96.—Fish bucket

Large packs for the back are made in the same way, from balsam or other bark, but laced up along the sides, stiffened by a couple of hoops on the inside, and fitted with a pack strap of bark or plaited fiber. A flap to cover it, if wanted, is provided by an extension of the bark at the top, which is rossed off to make it flexible. Such a carrier is called by the French Canadians a *corseau* (from *casseau*). In warm weather it is more comfortable to carry than a blanket pack, as it does not sweat the back.

BAST ROPES AND TWINE.—Straps, fish-stringers, etc., are made from the whole bark of pawpaw,

leatherwood (remarkably strong), and hickory shoots. Very good ropes and twine can be made from the fibers of the inner bark of the slippery, white, and winged elms, the pignut and other hickories, white oak, and buckeye, red cedar, yellow locust, red mulberry, and Osage-orange. One who has not examined the finished work would scarce believe what strong, soft, and durable cordage, matting, braided tump-lines, and even thread, fish-nets, and garments can be made from such materials by proper manipulation. The Indians first separate the bark in long strips, remove the woody outer layer, and then boil it in a lye of sifted wood ashes and water, which softens the fiber so it can be manipulated without breaking. After it is dried it can be separated into small filaments by pounding, the strings running with the grain for several feet. Slippery elm especially makes a pliable rope, soft to the touch; it can be closely braided, and is very durable. If the woody splinters and hard fragments have not been entirely removed by pounding, the shoulder blade of a deer is fastened to an upright post, an inch hole is drilled through it, and bunches of the boiled bark are pulled backward and forward through the hole. The filaments are then put up in hanks and hung aside for use, being boiled to supple them when needed.

Bark twine is made by holding in the left hand one end of the fiber as it is pulled from the hank, and separating it into two parts, which are laid across the thigh. The palm of the right hand is then rolled forward over both, so as to twist tightly the pair of strands, when they are permitted to unite and twist into a cord, the left hand drawing it away as completed. Other strands are twisted in to make the length of cord desired. Twine and thread are made from the bark of young sprouts.

The bast or inner rind of basswood (linden) makes good rope. More than a century ago, two Indians whose canoe had drifted, while they were

in a drunken sleep, upon Goat Island, between the American and Canadian falls of Niagara, let themselves down over the face of the cliff by a rope that they made from basswood bark, and thus escaped from what seemed to the on-lookers as certain death by starvation.

Mulberry and Osage orange bast yield a fine, white, flax-like fiber, that used to be spun by squaws to the thickness of packthread and then woven into garments. The inner bark of Indian hemp (*Apocynum cannabinum*), collected in the fall, is soft silky, and exceedingly strong. The woody stems are first soaked in water; then the bast, with bark adhering, is easily removed; after which the bark is washed off, leaving the yellowish-brown fiber ready to be picked apart and used. A rope made from it is stronger, and keeps longer in water, than one made from common hemp. It was formerly used by the Indians, almost all over the continent, not only for ropes, but for nets, threads, and garments. The fibers of the nettle were also similarly used.

In the southern Appalachians, it is not many years since the mountain women used to make bedcords (perhaps you know how strong such cords must be) by twisting or plaiting together long, slender splits of hickory wood (preferably mockernut) that they suppled by soaking. Such bed-cords are in use to this day.

Root and Vine Cordage.—The remarkably tough and pliable rootlets of white spruce, about the size of a quill, when barked, split, and suppled in water, are used by Indians to stitch together the bark plates of their birch canoes, the seams being smeared with the resin that exudes from the tree; also for sewing up bark tents, and utensils that will hold water. The finely divided roots are called by northern Indians *watab* or *watape*.

Twine and stout cords are also made of this material, strands for fish-nets being sometimes made

as much as fifty yards in length. The old-time Indians used to say that bark cords were better than hemp ropes, as they did not rot so quickly from alternate wetting and drying, nor were they so harsh and kinky, but, when damped, became as supple as leather. "Our bast cords," they said, "are always rather greasy in the water, and slip more easily through our hands. Nor do they cut the skin, like your ropes, when anything has to be pulled. Lastly, they feel rather warmer in winter."

The fibers of tamarack roots, and of hemlock, cedar, and cottonwood, are similarly used. Dan Beard says: "I have pulled up the young tamarack trees from where they grew in a cranberry 'mash' and used the long, cord-like roots for twine with which to tie up bundles. So pliable are these water-soaked roots that you can tie them in a knot with almost the same facility that you can your shoe-string. . . . Each section of the country has its own peculiar vegetable fiber which was known to the ancient red men and used by them for the purposes named. . . . Dig up the trailing roots of young firs or other saplings suitable for your use, test them and see if they can be twisted into cordage stout enough for your pvrpose. Coil the green roots and bury them under a heap of hot ashes from your camp-fire, and there allow them to steam in their own sap for an hour, then take them out, split them into halves and quarters, and soak them in water until they are pliable enough to braid into twine or twist into withes. Don't gather roots over one and one-half inches thick for this purpose."

The long, tough rootstocks of sedge or saw-grass are much used by our Indians as substitutes for twine. Baskets made of them are the strongest, most durable and costliest of all the ingenious products of the aboriginal basket-maker. The fiber is strongest when well moistened. The stringy roots of the catgut or devil's shoe-string (*Cracca* or *Te-*

phrosia), called also goat's rue or hoary pea, are tough and flexible.

Grapevine rope is made in a manner similar to bark rope. The American wistaria (*Kraunhia frutescens*) is so tenacious and supple that it was formerly used along the lower Mississippi for boats' cables; it can also be knotted with ease.

WITHES.—A favorite basket plant of the Apaches and Navajos is the ill-scented sumac or skunk-bush (*Rhus trilobata*), which is common from Illinois westward. The twigs are soaked in water, scraped, and then split. Baskets of this material are so made that they will hold water, and they are often used to cook in, by dropping hot stones in the water. A southern shrub, the supple-jack (*Berchemia scandens*), makes good withes. The fibers of the red-bud tree are said by basket-makers to equal in strength those of palm or bamboo. For such purpose as basket-making, withes should be gathered in spring or early summer, when the wood is full of sap and pliable. If the material is to be kept for some time before weaving, it should be buried in the ground to keep it fresh. In any case, a good soaking is necessary, and the work should be done while the withes are still wet and soft. Other good woods for withes are ash, white oak, hickory, yellow birch, leatherwood, liquidambar, willow, and witch hazel. Large withes for binding rails, raft logs, etc., are made from tall shoots or sprouts of hickory or other tough wood, by twisting at one end with the hands until the fiber separates into strands, making the withe pliable so that it can be knotted. This usually is done before cutting off the shoot from its roots. A sapling as thick as one's wrist can be twisted by cutting it down, chopping a notch in a log (making it a little wider at the bottom than at the top) trimming the butt of the sapling to fit loosely, driving in a wedge, and then twisting.

A withe is quickly fastened in place by drawing

the two ends tightly together, twisting them on each other into a knot, and shoving them under, as a farmer binds a sheaf of grain.

Hoops and Splits.—The best hoops are made from hickory, white or black ash, birch, alder, arborvitæ or other cedar, dogwood, and various oaks. Take sprouts or seedlings and split down the middle, leaving the outer side round. Thin the ends a little, and cut notches as in Fig. 97. An inside

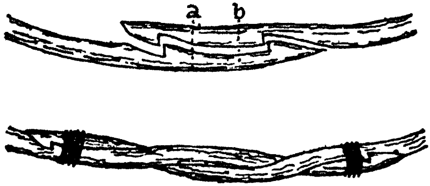


Fig. 97.—Becketing hoops

hoop, or any that is not subjected to much strain, is simply notched for a short overlap, as in the upper illustration; the ends are brought together, one on top of the other, and bound at *a* and *b*. A hoop to be driven on the outside of a keg or barrel has a long joint (lower figure); each end takes a half turn round the other, between notches, and the joint is then tied.

Splits for basket-making and similar purposes are commonly made of white oak, in spring or summer, when the sap is up. Select a straight-grained sapling, cut in lengths wanted, rive these into strips as wide as desired, then, with a knife, split these strips bastard (*i.e.,* along the rings of growth) to the proper thickness. Put them in water to soak until needed, if you want them pliable.

Splits are easily made from slippery elm, for instance, by taking saplings or limbs three or four inches in diameter, and hammering them with a wooden mallet until the individual layers of wood are detached from those underneath, then cutting these into thin narrow strips. The strips are

kept in coils until wanted for use, and then are soaked.

Black ash and basket oak, when green, separate easily into thin sheets or ribbons along the line of each annual ring of growth, when beaten with mallets. The Indians, in making split baskets, cut the wood into sticks as wide along the rings as the splits are to be, and perhaps two inches thick. These are then bent sharply in the plane of the radius of the rings, when they part into thin strips, nearly or quite as many of them as there are rings of growth.

CHAPTER XVI

KNOTS, HITCHES, AND LASHINGS

Much depends on knowing how to tie just the right knot or other fastening for a certain job. In learning to tie knots, do not use small twine, but rope or cord at least an eight of an inch thick. Take plenty of it in hand, and do not begin too near the end.

The main part of a rope is called the "standing part" (Fig. 98). When the end is bent back toward the standing part, the loop thus formed is called a "bight," regardless of whether it crosses the rope, as in the illustration, or only lies parallel with it.

For the sake of clearness, in the accompanying illustrations, *ends* are shown *pointed* like thongs, and standing parts are left open to indicate that they extend indefinitely. Parts of the knots are shaded to show plainly how the convolutions are formed.

STOPPER KNOTS.—A plain knot tied anywhere on a rope to keep it from slipping beyond that point through a bight, sheave, ring, or other hole, is called a stopper knot. Such a knot often is used, too, at the end of a rope to keep the strands from unlaying.

OVERHAND KNOT (Fig. 99).—Simplest of all knots. Often used as component part of other knots. Jams hard when under strain, and is hard to untie.

DOUBLE OVERHAND KNOT (Fig. 100).—If the end is passed through the bight two or more times before hauling taut, a larger knot is made than the simple overhand.

FIGURE-OF-EIGHT KNOT (Fig. 101).—Also

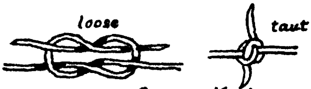
98. Parts of Rope.

99. Overhand Knot.

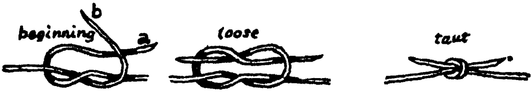
100. Double Overhand Knot.

101. Figure-of-eight Knot.

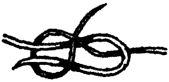
102. Thief Knot (will slip).



103. Granny Knot. (will slip).

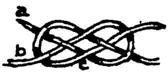


104. Reef Knot (holds, does not jam, easy to untie).



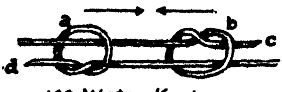
105. Weaver's Knot.

106. Double Bend.

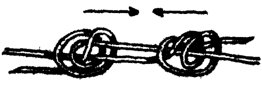


107. Carrick Bend.

108. Lapped Overhand Knot



109. Water Knot.



110. Double Water Knot

called Flemish or German knot. Used for the same purposes as the overhand knot, but more elegant and easier to untie. (See also p. 319.)

KNOTS FOR JOINING ROPES, ETC.—First are given illustrations of two knots that *never* are to be used, because both are treacherous. The thief knot (Fig. 102), with ends pointing in opposite directions, is sure to slip. It is a bungled weaver's knot (compare Fig. 105).

The granny or lubber's knot (Fig 103) is formed by passing the end *a* in Fig. 104 *over* instead of under the end *b*, and then bending *b* down under it. The result is that the loops cross over and under on opposite sides, instead of the same way on both sides. Such a knot, when drawn taut, has its ends sticking out and away from the standing part, and it is very likely to slip.

REEF KNOT (Fig. 104).—Known also as square or true knot. Will not slip, *unless* used in tying a small cord or rope to a thicker one. So long as the two ends are of equal diameter this knot may be relied upon. It has the advantage of being easy to untie. To make it, cross the two ends, *a* under *b*, turn *a* over and under *b*, bring the two ends up away from you, cross *a* under *b*, turn *b* under *a*, and draw taut by pulling the ends.

To untie, if the rope or cord is stiff enough, seize the standing part on each side, just outside the knot, push the hands together, and the loops slip over one another. If the material is limber, take one end in left hand and the standing part of the same end in the other, pull hard on both, and the knot becomes dislocated so that it is easily undone.

SURGEON'S KNOT.—This is the same as a reef knot except that, in making it, the end *a* is turned twice around the standing part of *b* before proceeding with the loop, just as in the double overhand knot (Fig. 100). It is used by surgeons in drawing tissue together, to prevent slipping of the first turn of the knot (see Fig. 193).

Weaver's Knot (Fig. 105).—Often called thumb knot, or, by sailors, becket bend or hitch, single or common bend. Almost the only knot by which two ropes of greatly differing sizes can be joined firmly together; also the quickest and most secure of all knots for joining threads or twine. Weavers tie it so deftly that the eye cannot follow their movements. To tie it as they do: (1) Cross the ends of two pieces of thread, the right one underneath the left, and hold them with thumb and finger where they cross; (2) with the other hand bring the standing part of right thread up over left thumb, down around its own end (which is projecting to the left), back in between the two ends, on top of the cross, and hold it there with left thumb; (3) slip the loop that is around thumb forward over end of left thread (which is projecting forward in line with thumb); (4) draw taut by drawing on both standing parts. The knack is in the third operation, which is done by raising knuckle of left thumb so that loop will slide forward, at the same time pushing end of left thread under it with right thumb (the two thumbs pointing straight toward each other). This can only be done with thread or soft twine.

This knot never slips, when properly made, but when ropes or cords of different thicknesses are joined with it, *make the eye on the stouter*, as shown in the figure. The weaver's knot is used in making nets, and has a great variety of other applications. When tied to a loop already made, such as the clew of a sail or a loop on a gut leader, the end is passed up through the loop, round the back of it, and under its own part.

Double Bend (Fig. 106) or Sheet Bend.—Same as above, except that the end is passed twice around the back of the loop before putting it under its own part. This gives it additional security when one line is thicker than the other. Often

used by fishermen in bending a line on the loop of a gut leader.

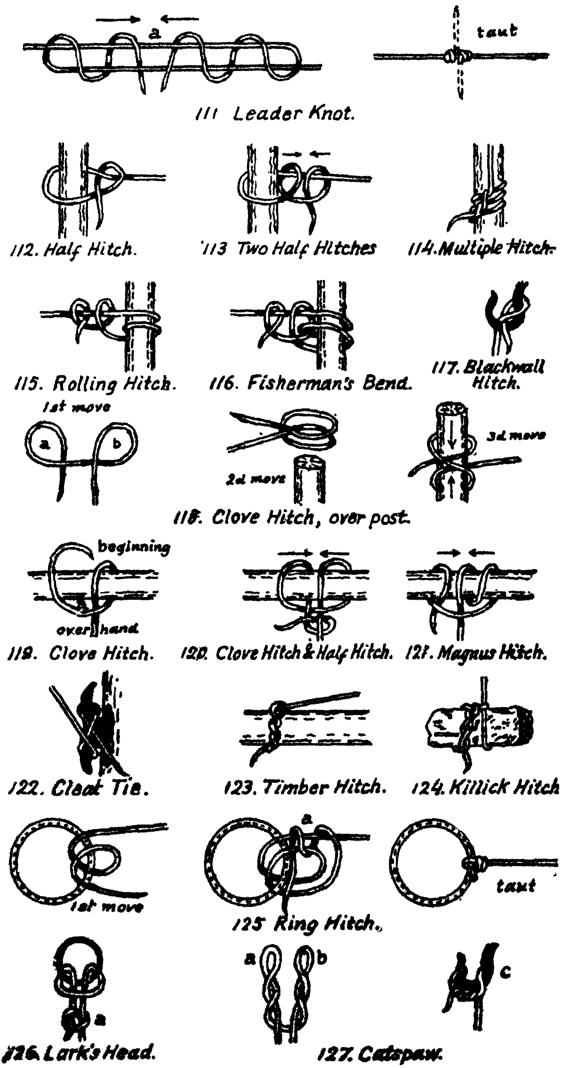
CARRICK BEND (Fig. 107).—Used for joining tow ropes together. Holds well, but is easily undone by pushing the loops inward toward each other. Lay the end of one rope *a* over the standing part *b;* put the end of another rope under the bight, over the other behind *a*, under the other at *b,* over at *c,* under its own part, out over the bight, and haul taut. Best of all knots for joining stiff ropes.

LAPPED OVERHAND KNOT (Fig. 108) OR OPEN-HAND KNOT.—A quick way of joining two lines or strands of gut together, and so used by fishermen to mend a broken cast when in a hurry, although it is not absolutely secure. Lay the two ends together and past each other about three inches; give these a turn over the right forefinger to form a loop; slip this off, and pass the two ends to the left through the loop and draw tight, snipping off the short end close to the knot. Rather clumsy, and more likely to break at the knot than elsewhere.

By passing the ends twice through the loop, as in Fig. 100, a very strong but bulky knot is formed.

WATER KNOT (Fig. 109) OR FISHERMAN'S KNOT.—A favorite knot for uniting strands of gut, in making leaders. (The strands should first be soaked several hours in tepid, soft water to make them soft and pliable.) Make a small overhand knot close to the end of one strand, *a*. Through this thrust the butt of another strand, and, close to the end of it, tie a similar knot around the first strand, *b*. Draw both of these knots pretty tight, and then pull them together by drawing on the two long ends. Tighten the two knots as much as possible, draw them together until they bed themselves in one knot, and snip off the protruding ends.

The water knot may be drawn apart by pulling on the ends *c* and *d*. This is an easy way to insert a dropper fly at any joint, as in Fig. 171.


a
taut
111 Leader Knot.
112. Half Hitch.
113 Two Half Hitches
114. Multiple Hitch.
115. Rolling Hitch.
116. Fisherman's Bend.
117. Blackwall Hitch.
1st move
a
b
2d move
3d move
118. Clove Hitch, over post.
beginning
overhand
119. Clove Hitch.
120. Clove Hitch & Half Hitch.
121. Magnus Hitch.
122. Cleat Tie.
123. Timber Hitch.
124. Killick Hitch.
1st move
a
taut
125 Ring Hitch.
a
126. Lark's Head.
a
b
c
127. Catspaw.

For thin gut, especially, the double water knot (Fig. 110) is preferable, as it is stronger and less apt to pull out. It is made like the other, except that the short end is passed twice round the other long part, instead of once, and then through both loops thus formed.

Leader Knot (Fig. 111).—In this knot, the ends, when snipped off close, are firmly held in the middle and guarded on each side by two round turns of gut; consequently the leader slips smoothly over or through obstacles. To make it, overlap the ends of the gut, as in Fig. 108, turn one end twice around the other and slip it between the two strands; then, gripping between thumb and finger at *a*, reverse the ends and twist the second part in the same way; shove and humor the knot taut, in direction shown by the arrows, and cut the ends off close.

Hitches.—A hitch is a twist, or combination of twists, to secure a rope or other line.

Half Hitch (Fig. 112).—Simply a turning in of the end of a rope.

Two Half Hitches (Fig. 113).—Another turn in the rope forms two half hitches, which, when drawn together, hold securely. This is the quickest and simplest way to make a rope fast to a post or ring. When subjected to heavy strain it is apt to jam so tight as to be hard to undo.

Multiple Hitches (Fig. 114).—Three or more half hitches bind so tightly on a pole that it can be hung vertically with a heavy weight on the lower end. Also used as an easy and pretty way of "serving" rope, and for covering bottles, jugs, etc., to preserve them from breaking.

Rolling Hitch (Fig. 115).—The quickest way to make a rope fast when it is under strain, and without letting up the strain in the act of securing it. Take two or three turns around the stake, pole or ring, then make two half hitches round the standing part, and haul taut. There are other and more elaborate rolling hitches. This one is often

called a "round turn and two half hitches," or simply a "sailor's knot." It is one of the most useful and easily made knots known.

FISHERMAN'S BEND (Fig. 116) OR ANCHOR BEND.—Take two turns round the object, as above, then make two half hitches, the first of which is *slipped under* both turns. A very secure fastening, but can only be made on a slack line. Chiefly used for bending a rope to a ring or to the shackle of an anchor, or for attaching a line to the bail of a bucket.

BLACKWALL HITCH (Fig. 117).—Simplest of all hitches. Used to attach the end of a rope to a hook, where the strain is steady. The strain on the first turn jams the end between it and the hook.

CLOVE HITCH (Figs. 118-120).—This is one of the simplest and yet most useful fastenings ever invented. It can be made under strain, will not slip on itself nor along the pole, and can easily be cast loose. It has numberless applications, from mooring vessels to setting up staging or reducing a dislocated thumb. Every woodsman should learn to make it in various positions.

To make it on a post, hold the rope in the left hand, give it a twist toward you with the right, and it automatically forms a loop (Fig. 118, *a*); hold this with the finger and thumb, give another twist in the same direction, and a second loop is formed (*b*); now, for the next move, bring *b* under *a*, as in the middle figure, slip them both over the post, shove them tight together, and haul taut. In this way a boat is moored, or a rope fastened to a tent pin, almost as quick as you would bat an eye.

Next learn to make the clove hitch on a long pole or other object that the loops cannot slip over: for instance, a horizontal rail. With rope coming from behind, pass the end forward over the rail, down and around it, back over the rope, up and over as in Fig. 119, and then bring the end out through the opening *a*.

Then tie it in reverse position, end pointing toward you. Observe that, in any case, the end goes round the pole the second time *always in the same direction* as the first, and that the end and the standing part comes out on opposite sides.

Absolutely to prevent slipping, take a half hitch around the standing part (Fig. 120).

All of these illustrations show the hitch before being drawn taut, which is in the direction of the arrows.

A clove hitch may be used to secure a small line to a stout rope. Since this hitch it not apt to slip along a smooth timber, it is used by builders in fitting up scaffolding. Its advantage in setting a dislocated limb is that, while it cannot slip, yet no amount of pulling will tighten it so as to stop the current of blood.

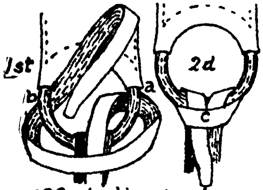
MAGNUS HITCH (Fig. 121).—Another easily made hitch that will not slip along a pole. It can be made with a line that is under strain.

CLEAT TIE (Fig. 122).—A quick fastening for a rope that is under strain. Never use it to make fast the mainsheet of a sailboat (see SLIPPERY HITCH, Fig. 138).

TIMBER HITCH (Fig. 123).—For dragging logs over the ground, or towing them through the water, the timber hitch has even greater gripping power than any of those hitherto mentioned. It cannot be made while there is a strain on the rope.

Pass the end of the rope around the timber, then round the standing part, then twist it two or more turns under and over itself. The pressure of the coils gives remarkable holding power. A timber hitch can be cast off easily. It is not reliable with new rope, and is liable to come adrift if the strain is intermittent.

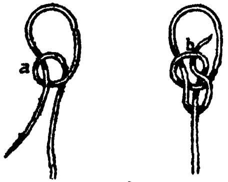
KILLICK HITCH (Fig. 124).— To secure a stone for a boat anchor, or for lifting similar objects, make a timber hitch, haul taut, and then make a single half hitch alongside it.



128 Latigo Lash

129. Openhand Eye Knot

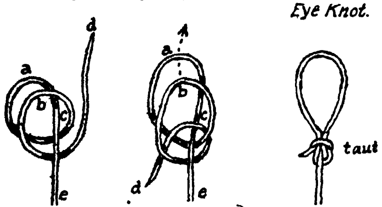
130. Midshipman's Hitch



131 Bowline Knot.

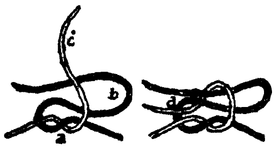
132. Fisherman's Eye Knot.

133. Loop Knot.

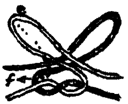


134 Central Draught Loop.

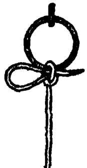
135. Slip Knot.



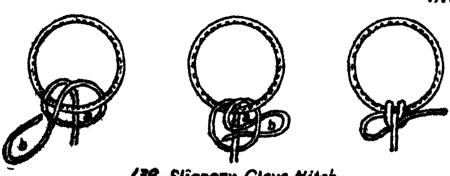
136. Draw Knot.



137. True Bow Knot.



138. Slippery Hitch.



139. Slippery Clove Hitch.

For towing slimy and slippery logs the same method is used, except that the half hitch is made a couple of feet in front of the other instead of alongside.

Ring Hitch (Fig. 125).—When tying a line or gut to a swivel ring, and for various other purposes, we want to secure attachment that is not clumsy and will not part at the knot. In the ring hitch the end fastening has no tendency to cut the line, and the draught is direct. If used in tying gut to a swivel, pass it twice around the swivel ring as shown in "first move"; pass the end over to the far side, and bring it through the double loop toward you at *a;* pass it over again and bring it through as before, but toward the swivel. See that these two turns are not too loose, and pull tight on the standing part first while still keeping a good strain on the standing part. With tweezers tighten the short end, then snip it off close. Cover the knot with a good blob of celluloid varnish (old photo films soaked in hot water, scrubbed with a stiff nail brush on exposed side, cut in pieces, and dissolved in acetone).

Lark's Head (Fig. 126).—A bight of the rope is passed through the ring, and the ends are then drawn through the bight. To make this tie more secure a half hitch (*a*) may be added.

Catspaw (Fig. 127).—This is for hitching a rope on to the hook of a block for hoisting. The simplest form is here shown. First you make two bights in a rope, then, with a bight in each hand, take two or three twists from you; bring the two bights side by side, and throw their loops (*a, b*) over the hook (*c*).

Latigo Lash (Fig. 128).—Used in cinching a saddle, the latigo being the strap by which the girth is lashed to a ring at the other end of the girth. Pass the latigo through the ring from outside to inside; down to ring that holds latigo itself, and through that from inside to outside, and up; through

upper ring from outside, passing under and out at the right (*a*). Then bring strap forward horizontally to the left; pass it around back of ring (*b*) and then out through ring to the front, as in first illustration. Now pass end of latigo down through the horizontal loop (*c*). Cinch and pull tight, as in second illustration.

LOOP KNOTS.—These are for forming eyes that will not slip, in the end of a rope or other line, or to make secure fastenings for various purposes.

OPENHAND EYE KNOT (Fig. 129).—Lay the end back along the standing part far enough to make an overhand knot with the doubled line, leaving a loop projecting. Very easy to make, and will not slip, but it does not give a direct pull, and one strand is likely to cut the other; hence a poor way to make, for instance, a loop at the end of a gut leader.

MIDSHIPMAN'S HITCH (Fig. 130).—Practically a loop secured by a magnus hitch. The strain is direct, and the knot easy to make and undo. Often used for attaching a tail-block to a rope.

BOWLINE KNOT (Fig. 131).—Pronounced *bo-lin*. Most important of all loop knots, as it is perfectly dependable, cannot slip, cannot jam, and is easily cast loose. It has innumerable uses.

Form a small bight (*a*) on the standing part, leaving the end long enough for the loop, and bring the end down through the bight; pass the end *under* and around the standing part, back *over* and then *under* the bight (*b*); draw loop snug, and pull on standing part to haul taut.

It is immaterial whether the bight is made to left, as here shown, or to right, provided the end is properly passed. Learn to tie the bowline both overhand and underhand, with loop toward you and with it away from you.

A quick way to tie a bowline around a post, or through a ring, is to pass the end of the rope round the post, then take the standing part of the rope in

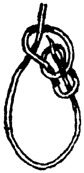
your left hand, the post being next to you, and the end of the rope in your *right* hand; lay the end over the standing part and make an overhand knot as if you were going to make a reef knot; then by a twist, capsize the knot so that it becomes a half hitch in the standing part. Now pass the end behind and around the standing part, away from the post, and back *down* through the same half-hitch. Then pull tight.

FISHERMAN'S EYE KNOT (Fig. 132).—A bight is first made, and an overhand knot is tied with the *standing part* around the other as in Fig. 135; the end is now passed round the standing part, and knotted in the same way. Thus there is a running knot *a* followed by a check knot *b*, which, when the loop is hauled on, jam tight against one another. The strain is divided equally between the two knots, and the loop will stand until the line parts. This is one of the best ways to make an eye on a fishing line or gut.

LOOP KNOT (Fig. 133).—Shown in the illustration as formed before drawing taut, which is done by pulling on the end with one hand and on left-hand side of loop with the other. Jams fast, but is not so strong as 131, 132, or 134.

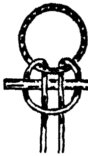
CENTRAL DRAUGHT LOOP (Fig. 134).—Another excellent loop for lines or gut, as it will not give nor cut itself. Make the bight *a*, then *b* over it, and pass the end *d* under the standing part; then thread *d* through the opening *c*, over the standing part, and out between the bights *a* and *b*. Now draw the bight *b* under and *through* the bight *a*, in the direction of the arrow. Haul taut by pulling on *e* and *d*.

SLIP KNOTS.—A plain slip knot or running knot is made by first forming a bight and then tying a common overhand knot with the end around the standing part (Fig. 135). It is a common knot for forming a noose, but inferior to the running bowline (Fig. 140).



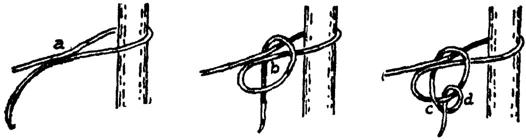
140. Running Bowline.

141 Running Noose with Stopper.

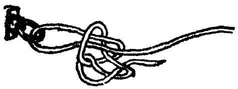


142 Lark Boat Knot.

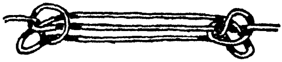
143. Sheet Bend with Toggle.



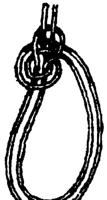
144. Hitching Tie.



145. Hitching Tie.

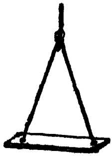


146. Sheepshank.

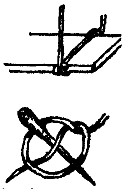


147. Bowline on a Bight.

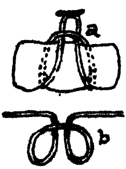
148. Man Sling.



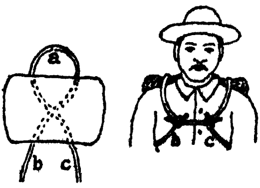
149. Boatswain's Chair.



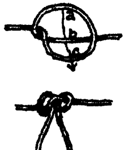
150. Plank Sling. (Marlinspike Hitch)



151. Bale Hitch.



152. Pack Sling.



153. Harness Hitch.

Draw Knot (Fig. 136).—This is tied just like a reef knot, except that after crossing the ends at *a* the right-hand end is bent back on itself to form a loop (*b*); then pass the left-hand end (*c*) *over* the loop, draw it back down *under* it, and out *over* at *d*. Remember the sequence: over, under, over—to reverse it would produce a granny knot.

True Bow Knot (Fig. 137).—This is the same as the preceding save that both ends are doubled back, and the loop *e* is drawn down under and out over, in the direction of the arrow. This is the way to fasten your shoe laces securely.

Slippery Hitch (Fig. 138).—This is a very common temporary fastening in tying up packages, fastening the painter of a boat to the ring of a pier, etc. A pull at the free end casts off the rope at once. Liable to come undone by accident.

Slippery Clove Hitch (Fig. 139).—A very useful hitch for fishermen and others, as it can be employed on a ring, eye knot, plain rope or line, or a pole or post. A ring is here used for illustration. Pass end of line up through the ring, down over it and behind the standing part of line, up over ring again (to the right) leaving an open loop at *a;* bend the end into a bight *b,* pass it back through loop *a,* and draw taut. It holds against direct strain as firmly as a clove hitch, but is freed instantly by a tug at the free end.

Running Bowline (Fig. 140).—This is merely a bowline with the main rope passed back through the large loop above *b* in Fig. 131. This forms a slip knot, its superiority to Fig. 135 being that its small loop cannot bind nor jam.

Two ropes may be joined together by making a bowline in the end of one and putting the end of the other through the bight, then forming with it another bowline on its own part—a method often used with heavy ropes or hawsers.

Running Noose with Stopper (Fig. 141).—A simple way of picketing a horse with a lariat,

though the bowline is better. The noose is made of right size for the horse's neck, and the overhand knot at the end prevents it from drawing tighter. This loop may also be used at the end of a bowstring.

LARK BOAT KNOT (Fig. 142).—A means of mooring a boat whereby the painter can be cast off instantly. A bight of the rope is put through the ring and a stick is thrust through in the manner shown. When the stick is pulled out the painter comes adrift of its own accord.

SHEET BEND WITH TOGGLE (Fig. 143).—Two ropes are joined together by a sheet bend (weaver's knot, Fig. 105), but, instead of drawing them taut against each other, a stick (toggle) is inserted for the same purpose as in a lark boat knot.

HITCHING TIE (Fig. 144).—Commonly used in hitching a horse. Pass the halter strap or rope around the post from left to right; bring it together and hold in the left hand at *a*. With right hand throw the end across, in front of the left hand, thus forming the loop *b*. Now reach with the right hand in through this loop, grasp the part of strap hanging straight down on the far side, and pull enough of it through *b* to form a bight *cd*. and slip end through *cd*. Then draw taut, with the knot turned to the *right* of the post. If the knot were turned to the left, or drawn directly in front of the post, it would not pull tight and would slide down a smooth post.

Another hitching tie is shown in Fig. 145.

SHORTENING ROPES.—If a rope is too long for its purpose there are many ways of shortening it for the time being without cutting. I show only one, a form of sheepshank (Fig. 146) which has two advantages: first, it can be used even where both ends of the rope are fast; second, it is secure by itself, without seizing (whipping the twine). Make a simple running knot, push a bend of the rope

through this loop, and draw the loop tight. The other end of the bend is fastened in a similar manner.

SLINGS.—These are used for a great variety of purposes. They must be absolutely secure, and yet, in many cases, they must be easy to undo.

BOWLINE ON A BIGHT (Fig. 147).—This is made like the common bowline except that the end is left long enough so that after it has passed out through the bight at *b* in Fig. 131 it is continued around the big loop and back around and out through *b* again, so as to double its course. When this is drawn taut you have two loops, instead of one as in the single bowline, and, like it, they cannot slip.

This is *the* sling for hoisting a man, or lowering him down a shaft, over a cliff, or out of a burning building. For this purpose, make one of the loops longer than the other, for him to sit in, while the shorter loop passes under his armpits and across his back, as in Fig. 148. The man grasps the ropes of the long loop, and is safely supported.

The bowline on a bight is also used in slinging casks or barrels, bales, etc. To untie it, draw the bight of the rope up on the standing parts until it is slack enough, then bring the whole of the other parts of the knot up through it.

BOATSWAIN'S CHAIR (Fig. 149).—A comfortable seat for painters or others working on the side of a building or for similar purposes. The rope goes through auger holes in the board and is secured above by a bowline knot.

PLANK SLING (Fig. 150).—Each end of a plank used as a stage is fastened to a rope by making a marlinspike hitch in the rope and running the end of the plank through it in the same way as the marlinspike in the lower figure.

BALE HITCH (Fig. 151).—Bend the middle of the rope over the back of the package as indicated by the dotted lines, bring the ends up over the front of it at *a*, and out under the bend, using the

two long ends to hoist or lower by. A parcel can be carried easily by using a short rope in this way and knotting the ends together for a handle, forming an extemporized shawl-strap. In portaging, the two ends are brought forward over the man's shoulders and held in his hands; the pack can be dropped instantly if he should slip or stumble.

This hitch is used in another way to attach an article to a line that has both ends fastened, for example, a sinker to a fishing line. Gather a loop in the line and bend it back on itself, Fig. 151*b*, slip the sinker through the double loop thus formed, and tighten by hauling on the two ends.

Pack Sling (Fig. 152).—Make a loop *a* in the middle of a rope, with ends crossed as shown, *b, c*, and lay the rope on a log or stump. Place the folded pack on the rope. Back up to it and pull the loop *a* over your head and down under your chin. Pass the ends *b, c*, up through the loop, cinch them tight, and tie each with a slip knot.

Harness Hitch (Fig. 153) or Artillery Knot.—Although not a sling, this hitch is introduced here for convenience sake. Enables one to make a loop quickly in a rope or line, the ends of which are already engaged. Derives its names from being the best way to harness men to a rope for towing boats, dragging guns, etc., where horses cannot be employed. The loop is thrown over a man's shoulder so he can exert his full strength. Make a large loop, laying the right end backward over the left. Pick up right side of loop and draw it toward you over the standing part in the position shown in upper diagram. Place the hand under *b* and grasp the rope at *a*. Draw *a* right through, as in lower diagram, and tighten.

Unless care is taken in drawing this knot close it is apt to turn itself in such manner as to slip, even though correctly made. It is best to put the right foot on the right hand part of the rope, or a foot on each side, to prevent slipping; then tighten.

CAN SLING (Fig. 154) OR BUTT SLING.—To improvise a bucket or a paint pot out of a can: pass the end of the cord under the bottom of the can, bring the two parts over it and make with them a loose overhand knot (*b*); draw the two parts down until they come around the upper edge of the can; haul taut, and knot them together over the can (*a*). To sling a barrel or cask, draw the two parts around the swell of the cask, near the middle, and leave two ends free to haul by.

LASHINGS.—I have space to show only a few of the more useful lashings.

PARCEL LASHING (Fig. 155).—Make a bowline knot in end of rope and run the standing part through it, thus forming a running bowline. Pass this loop around one end of the parcel (*a*) and cinch up (*i.e.*, draw taut). Run the line to *b*, and there throw a loop around the other end of the parcel, crossing the rope as at *d* (not *b*). Run the rope on around to the other side and take a turn around the cross rope as at *b* (under, over, over, and under), cinch and do the same at the other cross rope opposite *a*. Bring the rope around the end to *c*, and there hitch it fast by passing end over the cross rope above bowline, under the part running lengthwise, over bowline (cinch up), back over and under itself; then make a similar hitch with it in the reverse direction, and, if extra security is needed, make a third over the first at *b*.

This lashing is easy to cinch up, easy to cast off, and leaves the rope then with no knot in it.

PACKING HITCHES.—The various hitches used in packing on animals, with aparejo, sawbuck saddle, riding saddle, or merely with a piece of rope, are so numerous and require so much description that there is no room for them in this book. See the excellent special treatise by Lieut. C. J. Post on *Horse Packing* (Outing Pub. Co., New York).

BOTTLE CORK TIE (Fig. 156).—Make a com-

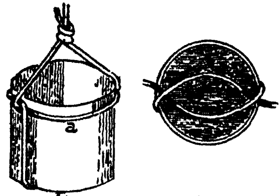


Fig. 154. Can Sling.

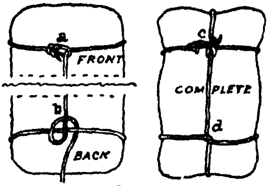


Fig. 155 Parcel Lashing.

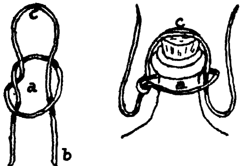


Fig. 156. Bottle Cork Tie.

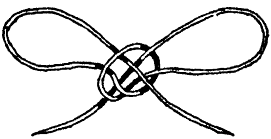


Fig. 157. Handcuff Knot.

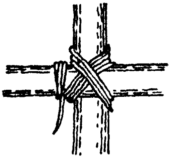


Fig. 158. Ledger Lashing.

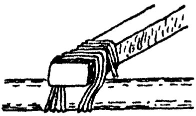


Fig. 159. Putlog Lashing.

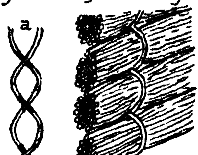


Fig. 160. Malay Hitch.

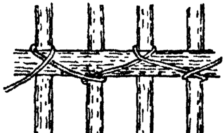


Fig. 161. Paling Hitch.

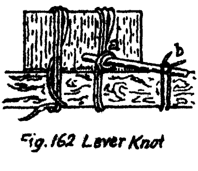


Fig. 162 Lever Knot

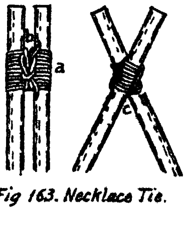


Fig 163. Necklace Tie.

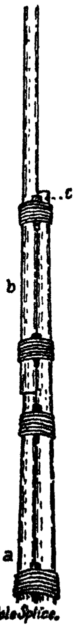


Fig. 164. Pole Splice.

mon slip knot like Fig. 135 (start an overhand knot, *a,* Fig. 156, but instead of drawing the end *b* through, leave it inside *a,* forming the upper loop *c*). Put the lower loop *a* down over the neck of the bottle with *c* over top of cork, draw taut, run the free ends up over the cork and tie them alongside of *c*.

HANDCUFF KNOT (Fig. 157).—Make a slip knot like the first part of Fig. 156, but return the end *b* back through the open knot so as to form a double loop or bow. Slip these loops over a man's wrists, draw taut, tie the loose ends firmly around the central part with a reef knot and you have him secured in a way that would baffle a "handcuff king." A prisoner can be secured even with a piece of fishline by tying his thumbs together behind his back with this knot.

Never fasten a prisoner's single wrist to your own: that would place him on equal terms. If he protests that the cords hurt him, or feigns sickness, "watch well lest you cure him too quickly."

LEDGER LASHING (Fig. 158).— A scaffold ledger or other horizontal stick is lashed to a vertical timber in the way here shown.

PUTLOG LASHING (Fig. 159).—A putlog or other squared timber may be roped to a horizontal pole in the manner illustrated.

MALAY HITCH (Fig. 160).—This is a quick way to fasten together wisps of grass, reeds, etc., for matting, or poles, planks, or other material for siding of temporary quarters. The whole affair can be shaken apart in a few moments leaving no knots in the ropes.

PALING HITCH (Fig. 161).—Used by Indians of the olden time to set up the framework of their houses, rawhide ropes being employed, which were put on wet and shrank very tight in drying. With ropes or vines, it can be used to secure small poles as palings to horizontal ones between posts, in making a tight fence around camp.

LEVER KNOT (Fig. 162).—To secure large pieces of timber together, or to lash articles fast to logs, such as a box to a raft: take two or three turns of rope somewhat loosely round the article and its support, then insert a stiff stick under the coils (*a*) and twist round until all the slack is taken out and the cordage is taut; the end of the lever is then secured with cord (*b*).

A similar appliance may be used as a vice, or to get a powerful grip on a smooth round object, such as a large pipe. The degree of tension is limited only by the strength of the rope and the length of the lever.

NECKLACE TIE (Fig. 163) OR PORTUGUESE KNOT.—Used to hold two timbers or hawsers side by side, and for lashing shear legs. The lashing is passed round and round the two objects to be joined (*a*), only a few turns being taken in the case of shears, then the lashings are brought round across themselves, from opposite directions (*b*) and tied with a reef knot.

When employed as a lashing for shear legs (*e.g.*, supports for the ridge pole of a tent) the crossing of the two legs puts a strain on the knot, holding it in place (*c*), yet there is enough play for the legs to be spread as far apart as desired, since the rope has been wound rather loosely for that purpose.

POLE SPLICE (Fig. 164).—If it is desired to set up a tall pole, and there is no material at hand that is long enough for the purpose, erect as good a pole as you can get, lash a shorter one to its lower part (*a*), resting on the ground, and, above this, butting on the top of the short one, lash another pole (*b*). Tighten the lashings by driving a wedge into each (*c*). The wedges must be rounded on the outer side to avoid cutting the ropes.

To splice a broken pole or the like, bind on a splint and wedge it as above: the splice will be more rigid than if screwed.

WINDING (Fig. 165).—In winding a fishing rod,

or other round object, we wish to leave no knot showing at either end. At the beginning, lay the end of the thread or twine lengthwise of the rod and take four turns around it (*a*) in the direction that the end points. Draw taut, and cut the projecting end off with a sharp knife. Then continue your winding almost as far as you wish it to go. Now make a loop of a bit of waxed thread (*b*), lay it lengthwise of the rod, as you did *a*, and wrap several turns over it. To finish this end, cut off your thread a few inches beyond the last turn, slip it through the end of the projecting loop (*c*), and pull back on *b* until the end of the thread has been drawn out at the point where the wrapping started around the loop; then snip it off close. During the winding, be careful to keep an even tension and the turns snug against each other. This is accomplished by turning the rod itself, instead of winding the thread round and round. It will help if you put the right-hand end of the rod against the far side of some support, so you can draw back on the thread while turning.

Another way is to wind over a needle, instead of a loop of thread, and, when you have gone far enough, pass the free end of your thread through the needle's eye and draw it back.

Either of these is a better way for *long* windings than the common one of laying a loop along the rod the whole length of the wrapping, as you did the end *a*, and drawing it back to finish off, as the loop gives considerable trouble.

In whipping the end of a rope so that the end may not unravel, begin the same as above. When within three or four laps of the finish, make a loop with the twine or yarn, holding the end firmly down with the thumb, wind three or four turns around the loop, then pull it back and cut off the end.

Anglers' Knots.—I have already described the best ways of joining lines together (Figs. 108-111) and of making loops on the ends of lines or leaders

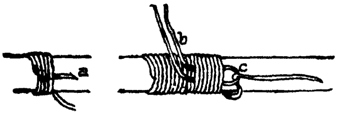


Fig. 165. Rod Winding.

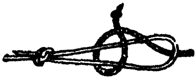


Fig. 166. Loop Bend.

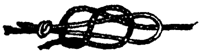


Fig. 167. Eight Bend.

Fig. 168. Jam Hitch.

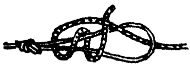


Fig. 169. Double Hitch.

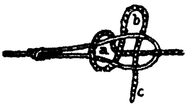


Fig. 170. Tiller Hitch.

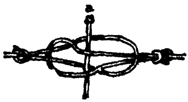


Fig. 171. Double Loop.

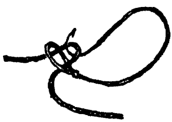


Fig. 172. Loop to Line.

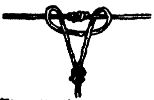


Fig. 173. Loop on Knot.

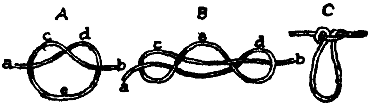


Fig. 174. Half Hitch Jam Knot.

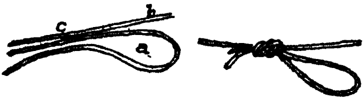


Fig. 175. Common Dropper Loop.

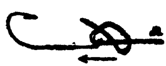


Fig. 176. Jam Knot.

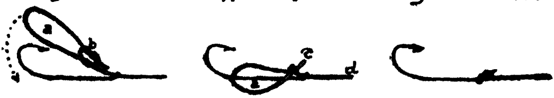


Fig. 177. Turle Knot.

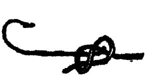


Fig. 178. Eight Knot.

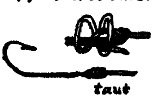


Fig. 179. Reverse Knot.

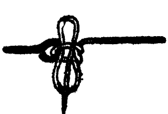


Fig. 180. Bow Knot.

(Figs. 129-134) Following are special knots for joining lines to loops, loops to loops, for making dropper loops, and for tying on hooks, sinkers, etc.

Loop Bend (Fig. 166).—The quickest way to attach a line to a leader loop. Knot the end of the line, pass it through the loop, around the outside of it, back under itself, and draw taut, leaving nothing but the knot projecting. Fairly secure, compact, and easy to undo. Sometimes called jam hitch.

Eight Bend (Fig. 167).—Same as above but with the line carried back over itself and forward under the first formed loop. Really a figure-of-eight knot. More secure than the plain loop bend, and almost as easy to cast off.

Jam Hitch (Fig. 168).—A neat hitch, and quite safe. To loosen it, shove the loops apart.

Double Hitch (Fig. 169).—Very secure, and neat. To loosen, push forward on line.

Tiller Hitch (Fig. 170).—A bit clumsy, but reliable, and easiest of all to cast loose, which is done by a tug at *c,* when the line instantly comes adrift. This can be done in the dark.

Holding the leader loop in left hand, catch the main line within two inches of the end by the same finger and thumb, underneath the knot of the leader loop; pass the line across the loop, fetch the loose end up over it, and double it into a loop, which is now passed into the head of the leader loop, and all drawn taut.

Another way to make this slip knot is first to bend the end of the line into the shape shown in the figure (*a, b, c*) ; now pass the leader loop *down* through *a,* raise it over the loop *b* and drop it down around it to the main line; then draw tight.

Double Loop (Fig. 171).—The end of a leader usually is looped, and so is the gut of most flies and snelled hooks. To join these, push the loop of the snell through that of the leader, then the hook through the loop of its snell, and draw tight.

If there is no loop on the fly, the leader may be made with a loop at each end where the dropper fly is to be attached, these loops joined as above, a knot tied in the end of the dropper fly's snell, and this inserted like *a* in the figure, before drawing taut. A looped snell can be used in the same way, gripped in the joint, just below its knot, and with its own loop projecting above. This makes it easy to change flies.

LOOP TO LINE (Fig. 172).—A snelled hook can be readily attached to a line anywhere except at the end, by bending the line into a bight, slipping the loop of the snell over the bight, the hook up through as shown, and drawing tight. A dropper fly can be hitched to a leader that has no loop, in the same way, but the strain may eventually cut the leader.

LOOP OVER KNOT (Fig. 173).—In a similar way a looped snell is hitched over a knot in a leader when the leader has no dropper loop.

A split shot for sinker can be attached to a line or leader in the same way. Close it on a loop of thread just large enough for the shot to pass through, and loop the sinker on the leader just above a knot. The thread being relatively weak, it will break if the sinker gets caught, instead of breaking the gut.

HALF HITCH JAM KNOT (Fig. 174).—To make a dropper loop anywhere on a line or leader, this method may be employed. First make a common half hitch (*A*). Then spread *c* and *d* apart and bring *e* up between them (*B*). Now draw the ends *a* and *b* taut, and a loop is formed (*C*) which stands at right angle to the line or leader. If the dropper loop does not stand straight away from the leader, like this one, it is likely to cause a fine snell to foul in casting.

COMMON DROPPER LOOP (Fig. 175).—The usual way of tying a dropper loop is to bend the end of one strand back against itself (*a*) into the form of a loop, lay it alongside the next strand (*b*) which runs toward the main line, then make a common over-

hand knot at *c* with all of them together. Of course, the gut must be well soaked and soft. Having drawn them tight, take the loop *a* in one hand and the upper end *b* in the other, and pull them strongly apart, so that the loop will point outward nearly at a right angle, instead of lying close along the line.

With light leaders it is better to make the loop of a separate piece of gut, somewhat heavier and stiffer than the main strands, lay it alongside a complete leader and tie as above. It will stand away at the proper angle.

JAM KNOT (Fig. 176).—To attach an eyed fly or hook to gut: Push one end of gut through the eye toward bend of hook; bring it back and make with it a slip knot around the gut, as in the figure, leave this open so it will pass forward over the eye of the hook, which is done by pulling at *a*. Draw tight, and clip off the protruding end.

TURLE KNOT (Fig. 177).—Pass end of gut through eye, and draw hook well up on gut to be out of the way. Make a running loop (*a*) with end of gut; draw the knot (*b*) nearly tight; pass hook through the loop thus made, and bring knot to eye of hook; draw tight by pulling first on *c*, then on *d*, and clip off end. This is particularly a good knot for eyed flies.

FIGURE-OF-EIGHT KNOT FOR HOOKS (Fig. 178). —A secure knot, more easily loosened than the turle knot.

REVERSE KNOT (Fig. 179).—Pass end of gut through eye of hook, take two turns with it around the leader, then stick it backward under the turn nearest the eye, draw taut, and clip off.

SINGLE BOW KNOT (Fig. 180).—Sometimes used for attaching hook to line when it is desired to change quickly.

CHAPTER XVII

TROPHIES.—PELTS, BUCKSKIN AND RAWHIDE

The preparation of game heads, or of entire skins, for subsequent mounting or tanning is not very difficult, even for an amateur, if one goes about it in the right way. A few simple rules may be given at the start:

1. Skin the specimen in such a way that the taxidermist can mount it in lifelike attitude and natural proportions. Make as few incisions as need be, and these in places where the seams will not show.

2. Remove every bit of fat, flesh and cartilage that you can. This is very important, but be careful not to cut through the skin.

3. Dry thoroughly *in the shade;* not in the sun nor before a fire.

4. Furred pelts are dried on stretchers, but specimens to be mounted by a taxidermist must *not* be stretched at all.

5. Pelts are to be dried without salt or other preservative, except under conditions mentioned below. Heads are best dried in the same way, unless the weather is damp, or you are collecting in a warm climate.

Many a fine head has been spoiled by not leaving enough of the neck skin attached to give it a good poise in mounting. Many more are ruined by skimped or boggled work about the eyes, lips, and ears, or by leaving fat on the skin so that it gets "grease-burnt," or by rolling up the skin and leaving it in a warm or moist place until decay sets in.

Remember that the taxidermist or furrier must soak the skin to soften it before he can do anything else with it, and if it has been allowed to decay at all the hair will come out when soaked.

To make a good job of skinning is somewhat tedious, and to make buckskin or tan pelts calls for plenty of elbow-grease. Amateurs are apt to be taken in by humbugs who profess to teach quick and easy ways of doing these things. There is no nostrum nor hocus-pocus that will save you the trouble of good knife work in the field, or of real labor if you do your own tanning.

In skinning out heads, or full pelts, one can do pretty fair work with no other tool than a jackknife with two blades, one of them thin and pointed, the other thicker edged for scraping and for working close to bones. It is best, however, to have two knives. For making incisions and for skinning out the more delicate parts a good instrument is the taxidermist's knife shown in Fig. 181. It has a

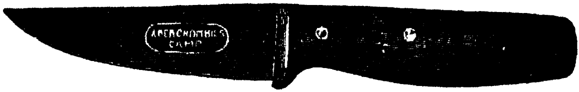


Fig. 181.—Taxidermist's knife

thin three-inch blade that takes a keen edge, weighs but two ounces, and costs 35 cents. Then have at hand a jackknife or a small hunting knife for the rougher work. You will need a whetstone, as skinning is hard on knife edges. When slitting a skin, use point of small blade, edge up, so you do not have to cut the hair.

When heads are to be skinned for mounting, one ought to have a pocket tape measure and make notes of actual dimensions on the animal itself. Since trappers and hunters of big game are afield only in cold weather, there is no need of arsenical soap or other chemical preservatives.

Skinning a Head.—Begin at a point over the backbone, close to the shoulder, and run the point of the small knife, just under the skin, down to the throat, then down the other side in the same way (*AB* in Fig. 182). Make these cuts close to the body where the swell of the shoulders and brisket begins, as the skin of the whole neck is needed to mount the trophy true to life. Then from *C* run the knife straight up the back of the neck to *D*, midway between the ears. From *D* make incisions to *EE* at the bases of the two antlers. (If the animal has no antlers or horns, then the cut from *C* to *D* is sufficient.)

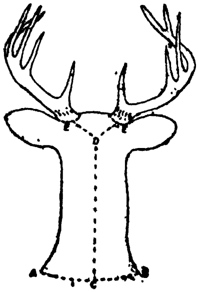


Fig. 182.—Skinning a head

Now begin to peel off the skin, working first from *C* down on each side. Pull away the skin with one hand while you assist with the knife in the other, cutting off the little ligaments as you go, so as to leave no flesh adhering to the skin, taking care not to cut the skin or rupture blood vessels. This kind of work is not to be done by a few heavy strokes, but by many light ones, holding the knife like a pencil. Peel forward to base of ears, and cut these off *close to the skull.* Then take up the V-shaped point between the ears (*D*) and skin off the scalp. Cut and pry the skin away from the base of each antler (*EE*) all around, working carefully and close to the base so as not to haggle edge of skin or leave hairs attached to antlers. It will help here to insert under the skin a small wedge-shaped stick, and pound a little on it.

Just above each eye is a depression in the skull, with no flesh between skin and bone, and the skin adheres tightly. Go slow here, cutting loose the skin to the very bottom of the cavities.

About the eyes you must proceed with great care, for if you cut the eyelids they cannot be repaired so as not to show the fault. Keep the blade close to bony rim of eye socket. Insert a finger into eye as guide, and cut through the membrane over the eye without puncturing the eyeball. Free the corners of the eyelids from the bone by neat work with the knife.

Pull off the skin as far as the nostrils and mouth. Here again you must work slowly and carefully. Sever the cartilage of the nose well back of the opening so the cut will not show from the front when head is mounted. When the lips are reached, cut close to the bone all around.

The skin being free from the skull, now proceed to remove the cartilage from the ears, so the taxidermist can insert metal forms that will preserve the natural contours. Many leave the cartilage in place, in ears, nose, and lips; but if this is done the parts will shrink and shrivel, besides being good prey for insects. Begin at the base of the *back* of the ear, separate the cartilage as far as you can with the knife, then start to turn the ear inside out, peeling as you go. Continue until you reach the point of the ear. Your wedge-shaped stick will come handy here. Having finished the back, then skin down the inside in the same way. Be careful not to cut the skin at the edge. Thus remove each cartilage entire.

Then pare away all the cartilage and flesh from the nose and lips, splitting them open for the purpose. If the head is that of a moose, the cartilage of its "bell" is to be removed.

Go over the entire skin and make sure that all fat and flesh have been removed, so it will keep well and so that when the taxidermist gets it his preservative will penetrate the skin evenly at all parts. Then wash it, inside and out, thoroughly, in cold or lukewarm water, to remove blood and dirt. Bloodstains are hard to remove from any kind of hair or

fur, and on some, as the caribou's, they cause a rust that cannot be eradicated. Finally, turn the skin inside out and hang it up in a cool, *shady* place to dry, spreading its folds smoothly apart, not wrinkled, so that air can circulate freely over all parts. *Never* roll a fresh hide up, expecting it to dry that way; it would surely spoil.

A skin dried thus without any preservative at all will soak up better when the taxidermist gets it than if it had been salted. If, however, the weather be damp all the time, you will have to use salt. In this case rub *plenty* of fine salt over every inch of the inner surface of the skin; then roll the skin up and let it lie until morning; do not stretch it nor hang it up by the nose. Next morning examine it carefully for soft spots where the salt has not struck in; shave these down and rub salt into them. Do not use any alum, for it would shrink the skin.

Then immediately hang up the skin in a shady place, well out of reach of dogs and vermin.

Meantime you will have the skull to attend to. Before removing it, make the following measurements and note them down as a guide to the taxidermist:

1. Length from base of skull to where neck joins the body.
2. Girth of neck at throat.
3. Girth at center.
4. Girth around *AB* where neck joined body.

Turn the head to one side and insert the knife between the base of the skull and the first or atlas vertebra, severing the muscles and tendons; then turn the head in the opposite direction and perform a similar operation there; give a wrench, and the skull is detached. Cut and scrape all flesh, etc., from the skull.

Disarticulate the lower jaw so that you can work better, and clean it. Remove the tongue and eyes. Now get a stiff stick, small enough to enter the hole in the base of the skull, splinter one end by pound-

ing it on a rock, and work this end around inside the skull so as to break up and remove the brain, using water to assist you. Wash out the inside of the skull, and tie the lower jaw in place.

HIDES.—How to remove and care for the entire skins of large animals is described in Vol. I., pp. 270-275. If they are to be used in making buckskin or rawhide, do not salt them.

Skins of bears, cougars, etc., that are to be made up into rugs may be skinned with either the whole head or only the scalp attached—the former if wanted mostly for decorative purposes, but practical minded folk prefer the latter, as these are not so mean to stumble over. If the animal has a large tail, slit the tail skin on the under side, the whole length. The tail bone must be removed in any case.

In skinning a bear slit it along the belly from chin to tail, and up the inside of each leg from toes to the belly slit. Skin out each foot by peeling the skin down and severing each toe just above base of nail. Skin out the ears like those of a deer, and the muzzle the same way if the whole head is to be preserved. The skin, being very fatty, requires careful fleshing. As there probably will be no time for this until the next day, spread the skin out on the ground, rub salt into it, and roll it up for the night, flesh side to flesh side. Next morning fix up a sapling for a "beam," as described under the head of BUCKSKIN, throw the skin over it, rub some cornmeal or ashes on it, and thoroughly scrape off the fat. Then salt the skin again.

To stretch and dry a skin, set up a rectangular frame, well braced, which may be made of saplings lashed or nailed together. Lace the skin to this frame, drawing as taut and evenly all around as you can (Fig. 183). The best way is with a sacking or sail needle and heavy twine. If you must make slits along the edges, from lack of a needle, cut them as small as practicable. Use a separate

length of twine or thong on each side, so that all four can be stretched or let out independently. This is far better than to tack the skin up on a door or the side of a barn, as it gives the air free access to both sides. Set the frame in an airy, shady place, out of reach of dogs and "varmints."

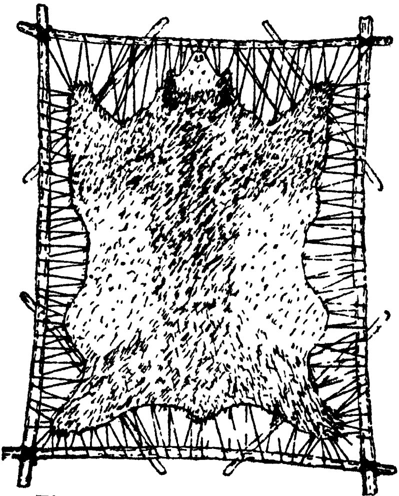


Fig. 183.—Bear skin stretched to dry

Another way to stretch a slit-open skin is to lace it up inside a hoop. Lay the skin out flat. Get a rod of elastic wood long enough to bend into a hoop that will go clear around the outside of the skin, or, if need be, splice two or more rods together for the purpose. Tie the skin to the hoop at opposite sides, then the other way, and so on until all loose parts are taken up and the skin is stretched tight as a drumhead.

The skull of a hornless animal is easily prepared for cleaning by simmering in water over the fire until the flesh begins to get tender (but beware of over-boiling, lest the sutures of the skull open and the teeth come loose); then remove the brain and scrape the skull.

Small Pelts.—Animals found frozen in the traps should be thawed out *gradually* before skinning—never by direct heat of the fire.

The wolf, coyote, wolverine, raccoon, and badger are skinned "open" and stretched square like a bear

skin. A beaver skin is slit open from chin to tail, but the legs are stripped out without slitting so that the skin may be stretched to oval form.

The lynx, wildcat, fox, otter, fisher, marten, mink, skunk, muskrat, and oppossum are skinned "cased," without slitting the belly. The skin, being now flesh side out, is dried on a stretcher as described hereafter. The reason for "casing" is that the furrier then can cut the pelt for himself to the best advantage, matching the best parts with those from other pelts, and making up separately the thin-furred or off-color parts.

In skinning a small animal "cased" it may be convenient to hang it up by the hind legs on a wooden gambrel thrust through the heel tendons, or on wire gambrel hooks, suspended by a short cord so that both hands can be used and the animal turned freely; but this is not necessary: if the beast is large, as a wolf or lynx, lay it on its back; if small, hold it on your knees.

Beginning at a hind foot, slit the skin along back of leg to base of tail, cutting carefully around the vent; then similarly along the other leg. If the feet are furred, skin them out with nails attached; if not, run the knife around the ankles. Peel the skin from the hind legs.

Tails of muskrat, beaver, and oppossum, being worthless, are chopped off where the fur ends, before skinning; those of other fur bearers are left on, the bone being completely removed, of course, or the tail would spoil. Cut a green stick about an inch thick and seven or eight inches long. Split it about half its length, work the skin loose from root of tail with finger and thumb until you can slip the split stick over the bone, then, pressing the sides of stick firmly so that the edges cannot slip over the skin, pull *hard* with it toward end of tail while your other hand pulls the body in the opposite direction, thus stripping the tail skin off "as slick as a whistle."

Make a small incision through tip of tail, and, before putting the pelt on a stretcher, run a switch through the tail sheath to open it up and allow the air to pass through it. If the tail sheath were left stuck together it would not cure properly and the fur would slip. This is the best way with mink and other animals that have tails more or less rat-like, and trappers generally practice it even on fox, raccoon, skunk, etc.; but if the animal has a thick, fleshy tail, the skin should rather be slit its entire length, on the under side, and spread flat for curing.

Next strip the skin down over the body. The front legs are easily worked out with the fingers. Sever the feet at the ankles, or skin them out with toes attached, as the case may require. Such skins as mink, marten, fisher, and fox may be slit up the back of the front legs to assure proper drying.

Peel the skin down over the head, using the knife gently. The ears are cut off not too close to the skull, the membranes cut through at the eyes, and the muzzle skinned off with lips and bare nose attached. The cartilage need not be removed, since the animal is not to be mounted.

Now go over the flesh side of the whole pelt and remove all adhering flesh and fat with the knife, but do not scrape thin at any place. Raccoon, skunk, and oppossum skins are fatty, like a bear's, and should be fleshed with particular care.

If the fur is dirty, or has blood spots on it, you must clean it with water and a rag (soap, too, if need be). A wet pelt should be dried by swinging it around in the air, before putting it on the stretcher.

As furs are of no value until freezing weather sets in, there is no need to salt the skins or use any other preservative; just dry them in the shade on stretchers.

Pelts of skunk, mink, etc., can be deodorized most effectively by soaking and washing them in gasoline

or benzine (away from a fire, of course); then wring out, and hang up in a current of air to dry, before stretching.

A "cased" skin is dried by slipping it over a thin board of proper shape and size so it is stretched tight like a drumhead. Stretchers are of various patterns. For muskrat the stretcher need be no more than a box board about 20 inches long, 5 or 6 inches wide at the base, and 4 or 5 inches at the shoulder, from which it is rounded off to the upper end. Dimensions depend, of course, on the size of the skin. The sides are chamfered so as to be thin along the edges, which are rounded.

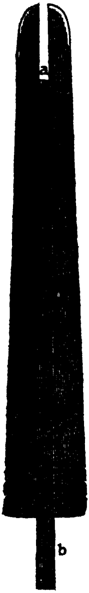


Fig. 184. Pelt stretcher (a, b, wedge)

To get the approximate size and shape for a stretcher, lay the animal on its back, on a board, and mark around it near the end of the fur. A fox skin will require a ½-inch board; otter, ¾-inch, and long enough so its tail can be spread out flat and tacked at full length. Slip the skin over the stretcher, fur side in, back on one side and belly on the other, and tack at the hind feet, or fasten to notches cut in edge of board. Then push in on each side a thin, narrow strip, or a stick to stretch the skin outward and let air get in. A few tacks at the base will complete the stretching. Then hang in some cool, dry, airy place until dry.

Another form of stretcher is shown in Fig. 184. The board is shaped as above, then a tapered piece is ripped from the center (*ab*), which, after the skin has been slipped on, is pushed forward like a wedge to stretch taut.

Bird Skins.—A sportsman may wish to save the skin of a particularly fine bird for mounting, and this can be done, in cool weather, without any

preservatives or taxidermist's equipment at all. You are likely to have some absorbent cotton or gauze in your first-aid kit. With this, plug the bird's throat, nostrils, and vent, and wipe off any blood that may have escaped from shot holes. The feathers must be disarranged as little as possible, and must be kept clean.

Lay the bird on its back, head to one side, and bend the wings backward out of the way. Part the feathers from point of breastbone to vent, and make an incision straight from one point to the other, being careful not to cut through the abdominal wall. Lift edge of skin and peel from body until thigh joint is exposed. Sever leg from body. Work thigh gradually out of skin, cut tendons free just above knee, and strip all flesh from bone. Do the same with the other leg. Use cotton or corn meal if blood or juice starts.

Set bird on end, tail up. Bend tail backward, and cut through vent lining, tail muscles, and backbone, being careful not to cut butts of tail feathers, or through skin of back. Work the skin loose from back, sides, and breast, to the wings, turning it inside out as you go. If the bird is large, you can work better if you hang it up by a wire hook and cord, thrusting the hook into pelvis.

Press wings forward strongly to loosen joint muscles, and detach them at shoulder joints. Peel skin off the head. Then gently stretch and push the skin over the swell of skull, inverting it entirely to the beak, pulling out ear linings and working with knife to free eyelids without marring them or puncturing the eyeball. Cut off neck at base of skull, including enough of skull to leave a hole through which brain may be scooped out. If the bird's head is too large to skin in this way, slit the skin from middle of back of head down nearly half the length of neck, and, through this incision, turn and clean the head.

Now remove eyes, brain, tongue, and jaw muscles,

scrape off whatever fat is on the skin, and return skull to its natural position inside the skin. Cut away all meat from leg and wing bones, and from base of tail, but without loosening tail feathers. Turn the skin right side out, smooth the plumage, and fill the cavity loosely with cotton.

BUCKSKIN.—To make good buckskin takes considerable manual labor; otherwise it is not difficult, and one can turn out a good article if he follows closely the directions here given—the regular Indian way, which I myself have used. Whether you make your own or not, it is well to know how real buckskin is made, so you may not be humbugged into buying base imitations.*

Genuine Indian-tanned buckskin is, properly speaking, not tanned at all. Tanned leather has undergone a chemical change, from the tannin or other chemicals used in converting it from the raw hide to leather. Buckskin, on the contrary, is still a raw skin that has been made supple and soft by breaking up the fibers mechanically and has then merely been treated with brains and smoke to preserve its softness. In color and pliability it is somewhat like what is called chamois skin, but it is far stronger and has the singular property that although it shrinks some after wetting and gets stiff in drying, it can easily be made soft as ever by merely rubbing it in the hands.

For some purposes buckskin is superior to any leather. It was used by our frontiersmen, as well

*"Much 'buckskin' nowadays comes from a sheep's back. I will give an infallible rule by which to tell genuine buckskin that comes from a deer's back. After the skin is tanned by 'any old process,' you will observe on the flesh side little veins, or channels where they once were. They are spread like the veins on the back of one's hands, only smaller. Where these are found on a hide or skin, you may rest assured it is buckskin off a deer's back."—(Farnham, *Home Manufacture of Furs and Skins.*)

as by the Indians, for moccasins, leggings, hunting shirts, gun covers and numerous other purposes. It is warmer than cloth, pliable as kid, noiseless against bushes, proof against thorns, collects no burs, wears like iron and its soft neutral color renders the wearer inconspicuous amid any surroundings. When of good quality it can be washed like a piece of cloth.

Its only fault is that it is very unpleasant to wear in wet weather; but against this is the consideration that buckskin can be prepared in the wilderness, with no materials save those furnished on the spot by the forest, the stream, and the animal itself. Not even salt is used in its manufacture. Neither tannin, nor any substitute for it, has touched a piece of buckskin; its fibers have been loosened and rendered permanently soft and flexible, its pores have been closed up, but there has been little or no chemical change from the raw state of the skin and consequently it has no tendency to rot.

INDIAN TAN.—Different Indian tribes have different methods of making buckskin, but the essential processes are the same, namely: (1) soaking, (2) depilating and fleshing, (3) stretching and treating with brains, with repeated soaking and drying, (4) smoking. The skin of a deer, for example, is first soaked in water for three to five days, depending upon temperature. Elk or buffalo hides are immersed in a lye of wood ashes and water or rolled up in ashes moistened with warm water. After soaking, the hide is taken to a graining log, which is simply a piece of sapling or small tree about 8 feet long and 6 or 8 inches thick at the butt. The bark is removed from the thick end and the other end is stuck under a root or otherwise fastened in the ground at an angle, leaving the smooth end about waist high, like a tanner's beam. Or, a short log may be used—one that will reach to a man's chin when stood on end; in which case a notch is cut in the butt by which the stick is braced

against the limb of a small tree, with smooth surface facing the operator, and the small end sticking in the ground about two feet from the tree.

A graining knife is now required. It was formerly made of hardwood, of flint, of the sharpened rib or scapula of an animal, or of the attached bones of a deer's foreleg with the front end of the ulna scraped sharp, the latter instrument being used like a spoke-shave. Sometimes a large, strong mussel shell was used. A favorite instrument was an adze or hoe-shaped tool made from the fork of an elk antler. After they could get iron, the squaws made skin-scrapers shaped like a little hoe, the handle being about a foot long. A similar tool for scraping small skins can be bought from dealers in taxidermists' materials. In the backwoods, however, one must commonly use an extemporized instrument. The back of a thin butcher knife does well enough, if filed square across so as to give a scraping edge, and the point of the blade driven into a stick for a handle at that end. Or, one can take a large half-round file or a rasp, grind it to a square edge on each side, draw out the point into a tang, fit a short oval handle crosswise on this end and a common file handle on the regular tang at the other end. A skate blade does very well. In fact, almost anything with a scraping rather than a cutting edge will answer the purpose.

The skin is placed on the graining log with the neck drawn over the upper end of the log about six or eight inches; the operator places a flat stick between the neck and his body, to prevent slipping, and presses his weight against it. If the short notched log is used, the neck is caught between the notch and the limb. The hair and grain (black epidermis) are scraped off by working the knife down the skin the way the hair runs. If the hair is stubborn, a little ashes rubbed into such spots will offer resistance to the knife and will make the grain slip.

The hide is now turned over and fleshed with a sharp knife, by removing all superfluous tissue and working the skin down to an even thickness throughout. This operation must be performed with extreme care or the buckskin will have thick and stiff spots which make it comparatively worthless—a point to be considered in buying buckskin. In olden times, when a squaw wanted to make something particularly nice, she would patiently work down a deerskin until it was almost as thin and pliable as a piece of cotton cloth. After cleaning in this manner the skin is allowed to dry and then is re-soaked overnight.

Softening the Skin.—Now comes the job of stretching and softening the hide. There is only one recipe for this: elbow-grease and plenty of it. The skin is pulled, twisted, and worked in every direction until it becomes white and soft, after which the operator rubs into it the brains of the animal, which have been removed by splitting the skull lengthwise half in two. Sometimes the brains are first dissolved in tepid water, being allowed to simmer over a slow fire while the lumps are rolled between the fingers till they form a paste which will dissolve more freely. This solution is then rubbed into the hide on the hair side, which is coarser than the flesh side. The brains act as a sort of dubbing; if there is not likely to be enough for the job, the macerated liver of the animal is added to the brains. Deer brains may be preserved by mixing them with moss so as to make the mass adhere enough to be formed into a cake which is hung by the fire to dry. Such a cake will keep for years. When wanted for dressing a hide, it is dissolved in hot water and the moss is removed.

A skin may be treated by soaking it in the solution, wringing out, drying and re-soaking till it is thoroughly penetrated. After this process the skin must again be pulled, stretched, kneaded, and rubbed, until the fiber is thoroughly loosened and

every part becomes as pliable as chamois skin. If two men are available they saw the hide back and forth over the sharpened edge of a plank or over a taut rope, lariat, or a twisted sinew as thick as one's finger. Large and refractory hides may be softened by stretching them firmly on elevated frames and dancing on them. It is a hard job for one man to soften a large hide, but he can accomplish it by throwing the wet skin over a convenient limb, forming a loop at the other end, passing a stout stick through it, and twisting into a hard knot—leaving it to dry; then he re-soaks it and repeats the operation as often as necessary. The oftener a skin is wet and softened, the more pliable it becomes.

Smoking the Skin.—The final process is smoking, which closes the pores, toughens the skin, gives it the desired color, and insures its drying soft after a wetting. Ordinarily the skin is made its own smoke-house. A small hole is dug in the ground and a smudge started in it. The best smudge is made from "dozed" wood, that is, from wood affected with dry rot until it is spongy; this, when dried, gives out a pale blue smoke without flame. If a particular shade of yellow or brown is desired, some discrimination must be used in selecting the fuel. Above all things, the smudge must not be allowed to break out in flame, for heating would ruin the skin. Several small poles are stuck around the hole and the skin is wrapped around them somewhat like a teepee cover, the edges being sewed or skewered together; it is best, when practicable, to smoke two or more skins at once, so as to have plenty of room around and above the smudge. When two skins of about equal size are ready, a good way to smoke them is to baste their edges together loosely in the form of a bag, the outside of the skins forming the inside of the bag and the after part of the skins forming its bottom, the neck end being left open; to the edges of the open end sew

a cloth continuation, leaving it open. Suspend this bag from its bottom to a tree or pole. Bend a small green stick into a hoop and place it within the bottom of the bag; under the mouth of the bag place a pan containing the smouldering wood (the cloth mouth is to prevent the skin from heating). Inspect the inside of the skins from time to time and when they are smoked to a deep yellow or light brown the process is finished; sometimes both sides of the skins are smoked; otherwise, fold the skins with the smoked side within and lay them away for a few days to season. This sets the color, making it permanent. The skins of antelope or any of the deer tribe are treated in the same way. Antelope, deer, moose, and caribou hides make good buckskin, but elk hides are comparatively weak and inferior material.

RAWHIDE.—Rawhide is often useful in camp and is easily prepared. Soak the fresh hide in water, or in a weak lye made by adding wood ashes to water, until the hair will slip. The alkali is not necessary for deerskins. Then remove the hair and stretch the hide with great force on a frame or on the side of a building, extending it in all directions as tightly as possible, so that when it dries it will be as taut as a drumhead. Dry it in the shade. Use no salt or other preservative.

This is all, unless you wish to make the rawhide supple, in which case rub into it thoroughly a mixture of equal parts of neat's foot oil and tallow, and work it thoroughly over the edge of a plank. Butter, lard, or any kind of animal grease will do as a substitute for the above mixture. Viscol, rubbed in, not only softens but waterproofs the skin.

A convenient way of making a stretching frame in the woods is to go where two trees grow at the right distance apart; notch them at the proper height to receive a strong, stiff sapling that has been cut to fit the notches, the deep cut of the latter

being at the lower side so that no force can pull the pole down; similarly fit another pole into reversed notches just above the ground; cut slits in the edges of the hide and from them stretch thongs or very strong cords to the trees and poles, twisting them up tightly.

Parfleche.—The plains Indians used to make rawhide trunks or boxes which would stand any amount of abuse in packing and travel. These were called by the voyageurs *parfleche.* (Our dictionaries surmise that this is a French adaptation of some Indian word, but it is simply Canadian-French, meaning an arrow-fender, because it was from rawhide that the Indians made their almost impenetrable shields. The word is commonly pronounced by Americans "par-flesh," with the accent on the last syllable.) In making these rawhide receptacles the thickest hides of buffalo bulls were dehaired, cut into the required shapes and stretched on wooden forms to dry; they then retained their shapes and were almost as hard as iron. A hide bucket can be made by cutting off from the rawhide some thin strips for lacing, soaking the skin until it is quite soft, shaping from it a bag, sewing this up with the lace-leather, fitting to it a handle of twisted or plaited hide, then filling the bucket with dry sand or earth and letting it stand till dry.

WHANG LEATHER.—Woodchuck skins are proverbially tough, and are good for whangs or shoestrings. Squirrel skins can be used for thinner ones. An old summer coon's skin is very good for this purpose; wildcat's skin is better; eel skins make the strongest of all whangs.

Whang-leather is prepared just like rawhide, but the thongs are cut out before softening. It is common practice to tan the leather with alum, but this is objectionable for reasons given in the next chapter. Many farmers "tan" small skins for whang-leather by putting them in a tub of soft soap; or dissolve a bar of shaved-up laundry soap in a pail of hot water, let it cool, soak the skin in this solution un-

til you can squeeze water through it, then wring it out, work by hand until dry, and finally smoke like buckskin. But such leather is of inferior strength, as the alkali weakens the fibers; it remains slippery; and it draws dampness till it rots. Plain rawhide, suppled with grease or oil, is stronger than any tanned leather.

Lace-leather is cut of uniform width by the following means. With a pair of compasses (a forked stick with pencil or metal scoring point attached to one leg will serve) draw a circle on a piece of hide; cut out this round piece with a keen knife; make a starting cut of the desired width on the edge of the circular piece of hide. Drive an awl or a slender round nail into a board, and alongside of it, at precisely the width of the lace, stick the knife, edge foremost, and inclining a little to the rear; then lay the round bit of hide in front of the knife, draw the cut strip between the awl and the knife and steadily pull away; the round leather will revolve as the knife cuts its way, and the awl, acting as a guage, will insure a uniform width of lacing. The same method is used in cutting shorter thongs from the side of a skin or piece of leather.

How to splice thongs is shown in Fig. 185. Cut a slit in the end of each, a little longer than width

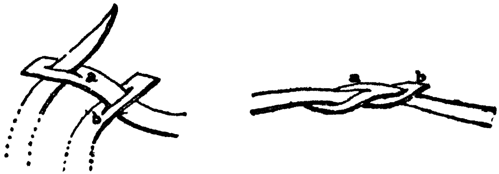


Fig. 185.—Splicing thongs

of thong, slip *b* over *a*, bring end of *b* up through the slit in *a*, and draw tight.

A Riata.—To make a rawhide riata: select carefully skinned hides that have no false cuts in them. A 30-foot riata will require two large cowhides if it is to be made three-stranded, or four

small ones if four-stranded. Having removed the hair, stake the hides out on level ground, keeping them well stretched and constantly wetted so as not to harden; keep them pegged out two days. Cut up the hide in the manner of laces, the width of the strip not exceeding one-half inch; wet each strip, when cut, and wrap it around a stick; then fasten the strips to a tree and plait them to a uniform circumference and tightness of twist. Keep the strands and plaited portion wet; a Mexican fills his mouth with water which he squirts over the work and materials. When the rope is finished, stretch it thoroughly, and then grease it. To preserve its pliability, keep it continually greased.

CATGUT.—The catgut of commerce is never made from cats, any more than chamois skin is made from chamois; but it can be made from the intestines of almost any good-sized animal. Thoroughly cleanse the intestine from all impurities, inside and out; this is more easily done while the gut is still warm from the animal. Wash it and then scrape it with a blunt knife to remove slime and grease; then steep it in running water for a day or two, so as to loosen both the inner and outer membranes, which are then removed by scraping. To turn the gut inside out, double back a few inches of one end, invert this, take the bag thus formed between finger and thumb and dip water up into it till the double fold is nearly full, when the weight of the water will cause the gut to become inverted. The fibrous inner membrane is then soaked three or four hours in water to which wood ashes have been added. It is then washed free from lye and can either be split into thin fibers when it has dried or may be twisted into a bowstring or similar cord. To twist it, plant two stout stakes in the ground, a little wider apart than the length of the gut; make a saw-cut in the top of each stake; cut two narrow, flat pieces of wood into the shape of knife-blades, thin enough to enter the saw-cuts, and notch one end

of each; firmly lash each end of the gut to one of these notched ends. By alternately twisting these and fixing them in the saw-cuts, to prevent their running back, the gut may be evenly and smoothly twisted like a single-strand cord. Let it dry and then rub it smooth with a woolen rag and a little grease.

MEMBRANES.—Bladders only need cleaning, inflation with air and drying to preserve them. They may then be made pliable by oiling. The paunches of animals, after cleaning, can be expanded with grass until dried. Such receptacles have many uses in wilderness camps, where bottles and cans are unobtainable; for example, to hold bear's oil, wild honey, and other fluid or semi-fluid substances.

SINEW.—A very strong, pliable and durable sewing thread is made from sinew. It splits into even threads, is easy to work with when damp, and, on drying, it shrinks tightly and becomes almost as hard as horn; hence it is better material than any vegetable fiber for certain kinds of sewing, particularly in sewing leather or buckskin, and for binding together any two parts, such as a tool and its handle, where the former has no eye. For bowstrings and heavy sewing, the Indians preferred the sinews of the buffalo or the moose, and then the elk, these being coarse in texture; for finer work they chose those of the deer, antelope, and bighorn. The sinew of the panther or mountain-lion was esteemed as the finest and most durable. The ligaments that extend from the head backwards along each side of the spinal process were preferred to those of the legs.

The aboriginal method of preparing and using sinew is thus described by Isham G. Allen: "The sinew is prepared for use by first removing all adhering flesh with the back of a knife; it is then stretched on a board or lodge-pole and left to dry for an hour or so, preparatory to the separation of the fibers or threads by twisting in the hands. By

the same or similar twisting motion, and by pulling, the fiber can be extended to a reasonable length. [Dried sinews may readily be shredded by wetting, and, if necessary, by gentle hammering.] Cords or small ropes are made by twisting many fibers together between two forked sticks fastened in the ground, and, during the process, rubbing with thin skins of the elk or deer to soften them; the largest cord I have seen made in this manner was one-fourth of an inch in diameter. To prepare it for sewing, the sinew is wet, and, at the needle end, rolled on the knee with the palm of the hand to a fine, hard point, like that of a shoemaker's bristle. As suggested, the sinews are made sufficiently fine for use in fixing the guiding feathers, and fastening the iron or flint heads of arrows, and in wrapping of clubs, etc. Formerly the awl used in sewing was of bone taken from the leg of the eagle; this has been displaced by the common sailor's needle; the overstitch is that most commonly employed in aboriginal sewing."

To join two slippery strands of sinew, lay their ends side by side, as in Fig. 108, and then with this double strand tie a figure-of-eight knot (Fig. 101).

Parchment.—It may sometime happen that one wishes to prepare a sheet of parchment on which to write an important document; this can be done in the wilderness, if one can kill some animal that has a gall-bladder. Make the parchment like ordinary rawhide, from the thin skin of a medium-sized animal, say a fawn or a wildcat. Rub it down with a flat piece of sandstone or pumice-stone. Then get a smooth, water-worn pebble and with it rub every part of one surface (hair side) of the skin, making it firm and smooth. Then give this a coat of gall diluted with water.

The old-fashioned way of making ox-gall was as follows: take the gall of a newly killed ox and after having allowed it to settle twelve or fifteen hours

in a basin, pour the floating liquor off the sediment into a small pan or cup, put the latter in a larger vessel that has a little boiling water in the bottom, and keep up a boiling heat until the liquor is somewhat thick; then spread this substance on a dish and place it before a fire till it becomes nearly dry. In this state it can be kept for years in a pot covered with paper, without undergoing any alteration. To use it, dissolve a piece the size of a pea in a tablespoonful of water. It makes ink or watercolors spread evenly on parchment, paper, or ivory. A coating of it sets lead-pencil or crayon marks so that they cannot be removed. It is also used for taking out spots of grease or oil.

Translucent Parchment.—To make parchment translucent, as for a window: take a raw skin, curried, and dried on a stretcher without any preservative; steep it in an infusion of water, boiled honey, and the white of eggs.

Another method is to soak a thin skin of parchment in a strong lye of wood ashes, often wringing it out, until you find that it is partly transparent; then stretch it on a frame and let it dry. This will be improved and made rain-proof if, after it is dry, you coat it on both sides with a clear mastic varnish, made as directed below.

Unsized paper or a thin skin is made waterproof and translucent by applying lightly to both sides a varnish made by putting ¼ ounce gum mastic in 6 ounces best spirits of turpentine, and shaking it up thoroughly, day by day, until dissolved. The bottle should be kept in a warm place while contents are dissolving.

Or, use equal parts Canada balsam (fir balsam) and turpentine: this dries slowly, but is flexible like map varnish.

Or, dissolve ½ ounce beeswax in ½ pint turpentine.

CHAPTER XVIII

TANNING SKINS—OTHER ANIMAL PRODUCTS

The methods used by regular tanners in making leather are complicated and beyond the resources of men in the woods. Vegetable tanning, with extracts or infusions of bark, etc., requires weeks or even months to complete the process. However, this sort of tanning is adapted mainly to heavy hides. Light skins, such as woodsmen usually handle, are best made into buckskin or else tanned with mineral salts or acids, which are comparatively quick and simple processes.

I will describe a good way to tan a pelt with the fur on. It may also be used to tan naked leather, except that the skin, in that case, is first soaked until the hair will slip and then grained like buckskin, before tanning.

Since one seldom makes a good job of tanning at the first trial, it is best to begin with a skin of little value, and one that is not of a greasy nature—a cat skin, for example, either wild or domestic. The tanning of a furred pelt proceeds in five stages: soaking, fleshing, pickling, washing, and softening:

1. *Soaking.*—A skin fresh from the animal needs no soaking, but one that has been dried must be relaxed before anything further can be done with it. Immerse the skin in running water from one to six hours (depending upon temperature, and thickness of skin), or, if this is not convenient, soak it in salted water, using a good handful of salt to the pailful. Take it out as soon as it is pliable, for

further soaking would loosen the hair or fur. Then flesh and pickle it at once.

2. *Fleshing.*—Even if the inside of a pelt has been well fleshed immediately after skinning, still, after it has dried, it will have a tough, glazed surface that must be cut and scraped away, after soaking, to open the pores so that the tanning liquor can penetrate at every point. Do this on a beam, as directed under BUCKSKIN in Chapter XVII. Thick hides must be shaved down uniformly before tanning.

If the skin is greasy, it will not take the tan. To remove grease, rub hot corn meal or sawdust, over the flesh side, being particular not to get it on the fur, as it might be hard to remove; then scrape well. An easier way is to soak the skin for an hour in gasoline, then hang up and dry before pickling.

3. *Pickling.*—Dissolve one quart of salt in one gallon of hot water. Let this cool, and then slowly pour into it one fluid ounce of commercial sulphuric acid. Do not inhale the fumes. These are the *proportions*: the amount, of course, will depend upon the size of skin and vessel used. The latter must not be of metal, but glass or earthenware, or a wooden pail or tub. Soak the skin in this, turning and working it around, once in a while, to ensure that every part gets the benefit of the tanning liquor. A thin skin will be tanned in about two days; a heavy one may take a week. The lower the temperature the slower the action. It will not hurt the pelt to let it stay in the pickle for months: taxidermists use this formula for preserving skins to be mounted at any future time. No, it does not injure hair or fur, but sets it, and discourages attack by moths and other insects.

If you are in a hurry, a stronger solution can be used: water two quarts, salt one pound, sulphuric acid one ounce, which will tan a light skin in about twenty-four hours; but this is likely to "burn" the

skin unless you soak it thoroughly in an alkaline solution after taking it from the pickle.

4. *Washing.*—In fact, any skin tanned with an acid should be neutralized with alkali so that no free acid is left in it to cause deterioration. First put the skin on a beam and go over the flesh side with a scraper to press out all the surplus liquid that you can. Then soak it an hour or so in a solution of common washing soda (about a handful to a pail of lukewarm water). Rinse in clear water. Many pelts have been spoiled by omitting this part of the program, and thus the acid tanning has gotten in some quarters, a bad name.

5. *Softening.*—After washing the skin, hang it spread out on a line or frame until half dry. Then work it back and forth (flesh side down, of course) over the edge of a plank or a square bar of iron, and pull and stretch it in every direction with the hands, until it is white, dry, and supple all over. The object is to loosen up the fibers everywhere so that they do not shrink, stick together, and dry hard and stiff. An amateur is more likely to fail here than in any other part of the tanning operation; for it is hard work, and he may not stick to it long enough to ensure a good job.

If still there are hard spots on the skin, moisten them with the pickling liquor and keep them so until softened. A good way is to cover such spots with sawdust wet with all the liquor it will take up.

A final finish can be put on by rubbing with sandpaper or pumice stone.

Then rub into the flesh side a mixture of equal parts of tallow and neat's foot oil, or some butter, or lard, or vaseline, or (sparingly) with plain oil or viscol. Do not use a vegetable oil. To remove any surplus, so that the skin may not be left greasy, rub hot corn meal or sawdust over it.

Finally, comb out the fur, and the pelt is ready for making up into a rug or garment.

There are many other ways of "mineral tanning"

but the one here given is less complicated than most of them, as satisfactory as any, and is adapted to any kind of skin, big or little, with or without the hair or fur. Tanning with alum I do not recommend: it shrinks and thickens the skin, hardens it, and makes the fur dull and harsh if any gets on it.

ROBES INDIAN-TANNED.—One may be so situated that he can get none of the ingredients required by the above process, and still he may want to make a robe with the fur on. In such case, do as the Indians did, who had not even salt. A pelt can be "Indian-tanned" as soft as by any chemical process, and will be even stronger and more durable. The only trouble is that it takes more elbow-grease.

The method is similar to that of making buckskin, already described, except that the hide is fleshed without soaking enough to make the fur slip. Then the skin is stretched, the brain water rubbed into the flesh side, this is repeated several times, and then the pelt is suppled by thorough hand work.

One of my earliest recollections is of the cosy warmth and peculiar but not unpleasant scent of buffalo robes, as I lay comfortably under them in the big sled and rode over the shimmering white prairie in a temperature of twenty or thirty below zero. The following description of how those robes were prepared is quoted from Colonel Dodge. We have no more buffaloes to hunt, but we have caribou and reindeer, and the same workmanship can be used on their hides, though a white man would use a beam and fleshing knife instead of the ground and a squaw's adze:

"The skin of even the youngest and fattest cow is, in its natural condition, much too thick for use, being unwieldy and lacking pliability. This thickness must be reduced at least one-half and the skin at the same time made soft and pliable. When the stretched skin has become dry and hard from the action of the sun, the woman goes to work with a small implement shaped somewhat like a carpenter's adze; it has a short handle of wood or elkhorn, tied

on with rawhide, and is used with one hand. With this tool the woman chips at the hardened skin, cutting off a thin shaving at every blow. The skill in the whole process consists in so directing and tempering the blows as to cut the skin, yet not cut too deep, and in finally obtaining a uniform thickness and perfectly smooth and even inner surface. To render the skin soft and pliable the chipping is stopped every little while and the chipped surface smeared with brains of buffalo, which are thoroughly rubbed in with a smooth stone. When very great care and delicacy are required the skin is stretched vertically on a frame of poles. It is claimed that the chipping process can be much more perfectly performed on a skin stretched in this way than on one stretched on the uneven and unyielding ground, but the latter is used for all common robes, because it is the easiest. When the thinning and softening process is completed, the robe is taken out of its frame, trimmed, and sometimes smoked. It is now ready for use. This is a long and tedious process and no one but an Indian would go through it."

Sometimes, after the fleshing of the hide was completed, a mixture of boiled brains, marrow grease, and pounded roast liver was thickly spread on the flesh side and allowed to dry in; then the hide was rubbed with fat, dampened with warm water, rolled up and laid away for a day. After this the hide was slowly dried in the sun or very carefully before a fire, being frequently and thoroughly rubbed over a riata while drying.

Snake Skins.—Slit the skin down the center of the under plates from head to tail. Work carefully with a rattlesnake's tail, as the skin from vent to rattle is thin and easily torn. If the skin cannot be tanned at once, rub fine salt into the flesh side, after scraping off foreign matter, roll it up and keep in a cool place. Otherwise apply the tanning pickle already mentioned, and tack the skin out on a board, in the shade, to dry. Afterward it can be softened with a little oil. For a short time after shedding, the skin is thin and tender.

To tan a snake's skin into flexible leather for a belt or similar article, the scales must first be scraped

off; then tan, and polish the outer side with a smooth but not hot iron.

Fish Skins.—If you merely skin a fish, salt the skin or put it up in brine and ship it to a taxidermist, you will finally get from him a mounted *thing,* but it will be a mighty poor reminder of the beauty that you caught. Whoever mounts a fish should have an exact replica of its body to use as a foundation. This can be made on the spot with plaster of Paris in a sand mold, as described in Pray's *Taxidermy* (Outing Handbooks), provided you have the plaster. Since very few anglers will be so equipped, it is best to preserve the fish itself, and ship it to a taxidermist as soon as practicable. Mr. Pray has told, in *Recreation,* how to do this with common preservatives that can be procured in any village:

"To prepare a fish to ship a distance for mounting, remove the entrails and red gills, slitting the belly open along the side to be against the panel when mounted. When the 'innards' are out, peel up the skin toward the back carefully and score the meat deeply lengthwise several times with a sharp knife, being careful not to cut through the skin on the opposite side.

Now rub plenty of borax (use no salt on a fish to be mounted) into the head and belly and the knife cuts in the meat of the back and tail.

Lastly, put a teaspoonful of carbolic acid (as you buy it in the drug store) into a pint of water and wring a cloth out of this solution. Wrap the fish in this, laid out full length. Have enough cloth so that several thicknesses of cloth cover the fish. (If two or more fish are shipped together, wrap each separately in the damp cloth.) Wrap the whole at full length in a piece of thin, cheap oil-cloth, pack carefully in a box and send by either parcel post or express. (Always lay the fish out in approximate pose in relation to each other that you would like in the mount, so that you will open them on opposite sides, that they may hang front to front on the panel.)

Always send fish for mounting in the meat, never skinned, as the *ideal* mounted fish is a cast portrait of itself with the skin skilfully applied over it."

GLUE.—Hoofs and horns are boiled down in water for many hours, until the water thickens, and this is cooled until it sets solid into glue. The oil skimmed from the pot in making glue is known as neat's foot oil, valuable in dressing leather.

To use the glue put the pan containing it into a small pot or pan partly filled with water, and heat this until the glue melts.

1. *Waterproof Glue.*—Soak the glue in water until swollen; then dissolve it by heating in four-fifths its weight of linseed oil.

2. Add some rosin to hot glue, and afterward dilute with turpentine.

3. Dissolve one pound of glue in two quarts of skim milk, by heating.

4. Take a handful of well burned quicklime and mix with it four ounces of linseed oil, rub the ingredients thoroughly together, and then boil until of the consistency of ordinary paste. Spread it on tin plates until it becomes dry and very hard. When required for use, heat it as you would common glue. This is not only waterproof, but also resists heat, and can be used as a lute for vessels.

CEMENTS AND PASTES.— Although these are not all animal products, I insert recipes here while on the subject of adhesives.

5. *Cement for Broken Vessels.*—A powerful cement or lute is made by kneading newly slaked lime (use a paddle) into a dough-like mass with a strong solution of glue, or blood, or white of egg.

6. *Cement for Casks, etc.*—A good cement for stopping leaks in casks, boats, etc., is made of tallow 25 parts, lard 40 parts, sifted wood ashes 25 parts. Mix together by heating, and apply with a knife blade that has just been heated.

7. *Flour Paste that will Keep.*—Make a strong tea of the bark of sassafras root. Mix flour in cold water to a thick paste, and stir into this the hot tea, gradually, until the paste is thin as wanted.

8. *Mucilage Substitute.*—Put a teaspoonful of

sugar in barely enough water to dissolve it, and let it come just to a boil.

WORKING IN HORN.—Horn is easily manipulated after soaking it in boiling water. If time permits, it is best to soak it first for several days in cold water, then boil until soft enough to mold into the desired shape. The horn must be kept free from anything sweaty or oily while being treated.

The western Indians used to make superior bows of buffalo horns, and from those of the mountain sheep, by leaving the horns in hot springs until they were perfectly malleable, then straightening them and cutting them into strips of suitable width. Two buffalo horns were pieced in the center and riveted; then bound strongly at the splice with sinew.

Turtle or tortoise-shell can be worked up in a similar way.

Horn is useful for handles, spoons, cups, and various other items of backwoods equipment. When split, flattened, and scraped, it makes good window panes where glass is unobtainable.

A *Horn Cup* is better than any other for one to carry with him when campaigning. It is lighter

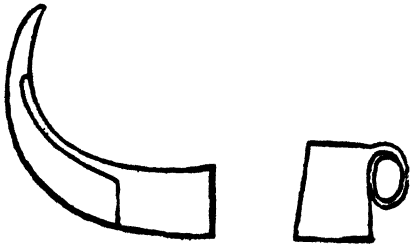


Fig. 186.—Horn cup

than a metal cup, does not dent nor break, and is pleasanter to drink tea or coffee from, as it is less conductive of heat.

To make it: Select the largest ox horn you can find that has a sharp bend in it. The broader

the base the better, so that the cup will not be tall and "tippy." Trim the butt end smooth and even for the bottom of the cup; then, back from this, at a distance equal to the proposed height of the cup, saw through the greater part of the horn, as shown in Fig 186, but leave enough of the top for a handle, the latter strip being about 6 inches long and ¾-inch wide. Scrape the handle gradually down to ⅛-inch thickness at the end. Then soak the handle in a strong boiling solution of lime until it is soft, bend it backward around a stick and bind the end fast to base of handle at top, until it has cooled and hardened; then fit a wooden bottom in it, and tack and lute it in place. A good cement or lute for the purpose is either No. 4 or No. 5, among the recipes given above. Before putting in the bottom, scrape and sandpaper the cup inside and out. The cup can be ornamented with scrimshaw carvings, like some of the revolutionary powder horns you see in museums.

A Huntsman's Horn.—The following description of how to make a huntsman's horn is condensed from one given a good many years ago by D. M. Morris: Select a cow's horn 14 to 16 inches long, although 12 inches will do. With a limber stick determine how far the hollow extends and saw off the tip about an inch above that point. With a gimlet bore down to the hollow, taking care to hit it fairly. Ream out the hole from ¼ to 5-16-inch diameter. Dress the horn down with a half-round file but do not scrape it. Be careful to get a fair and even surface. To avoid working the horn too thin, press the thumb on doubtful places to see if there is any spring. Work down the neck as much as it will safely bear. A brass ferrule should now be fitted tightly around the neck to prevent the stem of the mouthpiece from splitting it. Now, to polish the horn: take a piece of sandpaper 2 or 3 inches square, and

a little finer than the file, in the palm of the right hand; then, grasping the horn with the left hand, twist it around and around from end to end, occasionally rubbing it lengthwise. Continue this process with finer grades of sandpaper till the very finest has been used and complete the polishing with pumice or rotten stone and water. Then get from any dealer in musical instruments an E flat or cornet mouthpiece, fit it perfectly, drive it in tightly and your horn is complete. Or, take the small end of another horn, or the piece sawed off, and with a sharp and round-pointed pocket-knife work out a conical cavity at the large end, and make a hole through the small end for the stem. Work off the outside, shaping it in the form of a cone the sides of which are concaved near the base and convexed toward the stem. This shape will look well, and the top will be thick enough to rest easily against the lips. The hole should be about the size of a rye straw. The shape of the mouthpiece and the size of the hole—provided it be large enough—do not materially affect the horn. The stem of the mouthpiece should be ¾ to 1 inch long. If shorter, the sound will be too harsh; if longer, too soft and not far-sounding. Long horns produce flat sounds, shorter ones sharp sounds. A good horn may be heard three to three and a half miles. The best horns have a double curve (crooks in two directions), gradually tapering from butt to tip, highly colored, or with black or dark points. A part of the butt must always be removed, as it is thin and brittle.

Gun Oil.—It is easy to make excellent gun oil from the fat of almost any animal. Never use a vegetable oil on a firearm—it is sure to gum. Rattlesnake oil has more body than almost any other animal oil; but that of woodchucks, squirrels, 'coons, etc., is good. A fine oil can also be made from the fat of the ruffed grouse, or from the marrow of a deer's leg bones. Put the fat on a board and

with a sharp knife cut it up fine; then put it out in the hot sunlight, or warm it gently (do not let it get hot) before the fire; now force the oil through a strong cloth bag by squeezing it. To clarify it so that it will never become viscid, put it in a bottle with a charge of shot, or some shavings of lead, and stand the bottle where the sun's rays will strike it. A heavy deposit will fall. Repeat, and you will then have an oil equal to that of watch-makers, but with enough body to stay where it is put, rather than running down into the chamber of the gun so as to leave unprotected spots in the barrel. A large squirrel will yield over an ounce of tried oil, a fat woodchuck nearly a pint, and a bear several gallons—eight gallons of grease have been procured from a big grizzly.

Bear's Oil.—Bear's oil, by the way, is better than lard for shortening biscuit and for frying, and, when mixed with sugar and spread on bread, is not a bad substitute for butter and sirup. It is rendered by cooking in a pot hung high over a slow fire, so as not to scorch the fat, which would give off an acrid smell and make the oil less bland. No salt is added; the oil will keep sweet without it, unless in very hot weather (when it should be kept in a cool room, or in a spring, or in a pot sunk in the earth). The Indians, who were very fond of bear's grease, used to preserve it so that it would not turn rancid even when they were traveling in summer, by adding the inner bark of the slippery elm (one drachm to a pound of grease), keeping them heated together for a few minutes, and then straining off. They also used sassafras bark and wild cinnamon for the same purpose. Bear's oil is superior to olive oil for the table, and can be used with impunity by people whose stomachs will not endure pork fat. I happened to be rendering some bear's grease at the time of this writing. The yield was a gallon of oil to ten pounds of fat.

Rattlesnake Oil.—Rattlesnake oil is solemnly

regarded by the old-fashioned Pennsylvania Dutch, and by many backwoods folk, as a specific for rheumatism, ringworm, sties, sore eyes generally, and even for hydrophobia! A large fat snake yields from two to two and a half ounces of oil. A piece of muslin is stretched over a glass jar, and the fat, which resembles that of a chicken, is spread on this. The hot summer sun renders it, and the muslin strains it. The Dutch are reported to have a curious way of telling whether the snake has bitten itself and thereby poisoned its fat. They drop a little of the oil into a glass of milk. If the oil floats as a film on top it is good; but if it separates into small beads and the milk gathers in thick white flakes, as though soured, it is a sign that the snake bit itself.

Slush Lamps.—While I am on the subject of animal fats and oils, I may as well say something about extemporized lights for a fixed camp that is far in the wilderness. A slush-lamp is made by taking a tin can, half filling it with sand or earth, sticking in it a thin rod of pine or other inflammable wood, wrapping around this a strip of soft cotton cloth, and filling the can with melted fat which contains no salt. Grease can be freed from salt by boiling it in water. This is a much better arrangement than to use a shallow dish (as I have seen done) or a mussel shell, and letting the end of the immersed wick project over one side, where it will drip grease. But such a light, although it was the best that many of our pioneers had in the olden days, is at best a smoky and stinking affair. The estimation in which it is held by those who have had to use it may be judged from the fact that in English-speaking countries it has universally been known as a "slut," except in the Klondike, where they call it a "bitch."

If more light is wanted than one wick will afford, use a square vessel with a wick at each corner. Make snuffers or tweezers, by bending a

piece of wire, with which to trim the wicks when they smoke.

A rush-light is made by soaking the pith of rushes in melted tallow. When dry, a length of the rush is then placed in a split stick, or any kind of clip, and lighted.

Candles.—Wherever deer, elk, or other animals whose fat is tallow, are procurable, there is no excuse but laziness for such vile illumination. Very satisfactory candles can be made by the following process, which is called "dipping." For wicking, use cotton cord loosely unwound, or dry shredded bark. Put your tallow in a kettle with some boiling water. One part of hog's lard to three of tallow may improve the product. A mixture of tallow and beeswax is still better. Scald and skim twice. Lay two poles sidewise and about a foot apart on supports, so that they shall be about as high from the ground as the top of an ordinary chair; cut some sticks about 15 or 18 inches long for candle rods; twist your wicking one way, then double it; slip the loop over the candle rod and twist the other way, making a firm wick; put about six wicks on each rod, a couple of inches apart. Dip a row of wicks into the melted tallow, place the rod across the two long poles, and thus dip each row of wicks in turn. Each will have time to cool and harden between the dips. If allowed to cool too fast they will crack: so work slowly. When the first dipping has hardened, repeat the process, and so on until the candles are of desired thickness. Replenish the tallow as needed, taking it off the fire, of course, for each dip. This is the way our foremothers made candles before they got candle molds.

For a candlestick, split the end of a stick for several inches, then again crosswise; open these segments by pushing a flat, thin stick down each; insert candle, and remove wedges; sharpen the other end of the stick, and jab it into the ground where-

ever wanted. Or, put a loop of bark in the cleft end of a stick, the loop projecting at one side. Or, cut the end of a large potato square off, and gouge a hole for the candle in the opposite end. Other makeshifts are to mold clay around butt of candle, with flat base; bore a hole in a block of wood, or drive three nails in it; use a hollow bone; or, if you want a candlestick attached like a bracket to a vertical pole, take a pocket-knife with blade at each end, drive one blade into pole so that knife sticks out at right angle, open the other blade half way, on top, and stick candle on it.

Candle Lanterns.—A very good lantern can be extemporized with a candle and a large tin can, or,

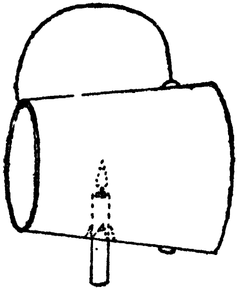


Fig. 187.—Lard pail lantern

better, a 5-lb. lard pail, the latter having the advantage that its flaring sides help to reflect the light. At a point a little beyond the middle of the can or pail make two cuts, crossing each other, through the tin, and bend the triangular points inward so as to grip the candle, when it is shoved up through the hole, and prevent it from slipping back. Then fix a wire bail on top. If a can is used, run the bail wire through a hole in the closed end, on through to the open end, and up into a loop for handle. If a pail, cut the candle hole directly in line with one of the bail ears, detach the bail from this ear, but leave it on the other, and run the free end around and hook it under flange of bottom (Fig. 187). The candle is shoved up only a little

inside the pail, at first, and shoved on farther as it burns down.

Torches.—If a dead pine tree can be found, chop off one of the old stubs of limbs, cutting deep into the trunk at the joint so as to get as much of the heavy resinous bulb as you can. Cut a few splinters on the big end of this pine knot, if need be, and light it.

A bark torch is made by peeling several strips of birch bark four or five inches wide, double or fold them several times if the strips are long, and place these bunches in the split end of a stick for handle. Or, take half-inch strips, two feet long or more, from the rough bark of a cedar, bind them together into a faggot with strings of the green inner bark, and set one end afire. It will not make much of a blaze, but will burn for several hours, giving at least enough light to read a compass by.

A good torch is made by winding cotton yarn or rags around a forked stick, in the form of a ball, and soaking in oil or melted tallow.

Southern Indians, when exploring caves, used joints of cane filled with deer's tallow and supplied with wicks.

Soap Making.—Soap can be made wherever there is wood and grease. A rough-and-ready way is to boil wood ashes from the camp-fire in a little soft water (rainwater is best, hard water will not do) and allow them to settle, the clear liquid being decanted off; this can be done from day to day until the required quantity of weak lye has accumulated. Evaporate this by boiling until it is strong enough to float an egg. Then melt down any kind of animal fat (do not have the kettle more than half full), and while it is hot, add it to the boiling lye. Continue boiling and stirring until the mixture is of about the consistency of thick porridge; then pour it into any flat vessel and let it cool. The result is soft soap. To make

hard soap, you have merely to stir into the above, as soon as it is poured out, some salt, in the proportion of two or three pints to five gallons of soap. A little powdered rosin added gradually to the melted tallow, before mixing with the lye, will make the soap firmer. Soap can be made without boiling, but it takes longer.

Lye-Running.—Only the ashes of hardwoods are good for lye; those of resinous woods will not mix with the fat in boiling. The woods richest in potash are hickory, sugar maple, ash, beech and buckeye. The poisonous kernels of buckeye are soapy and can be used to cleanse fine fabrics. As lye is often useful to a backwoods tanner, and for other purposes, it may be worth while to put up an ash-hopper at a permanent camp. Take a section of hollow tree, or a barrel with both heads knocked out, or with auger holes bored in bottom. Stand it on a wide board that is elevated high enough for a bucket to stand below it. Cut a Y-shaped groove in the board part way around the bottom of the barrel and out to front of board. Tilt the board a little and fasten it so that the liquor from the barrel will follow the grooved channel to the front of the board and thus trickle into a pail set below it. Now put two or three layers of small round sticks in the bottom of the barrel, laying each course crosswise of the one below, cob-house fashion, and on top of this lay a couple of inches of straw or coarse grass; then put your ashes in the barrel, tamping them down firmly as they are shoveled in; make a funnel-shaped depression in the top and pour a bucket of rainwater into it. It will be from half a day to a day before the leach will run. Thereafter keep some water standing in the depression, adding only when the other water has disappeared. If the ashes have been firmly tamped, the leach will only trickle through, and that is what you want. The first run will be strong enough to cut grease; later runs should be put through twice. Such lye needs no boiling down.

CHAPTER XIX

CAVE EXPLORATION

To those who love the tang of adventure in strange and untrodden places there is no experience, nowadays, that compares with opening up and exploring caverns. To find a mountain that has never been ascended, or a region on the earth's surface that has never been mapped, one must make long journeys and spend a fortune. Caves may be found wherever there are thick beds of permeable limestone with sink-holes on the surface, or other evidence of subterranean water-courses. The descent calls for no costly equipment. It may be made at any season of the year. The trip will take only a day or two. And cave exploration is a sport that yields quick results: the moment you get underground you are face to face with the unknown.

Yes, there may be nothing new under the sun, but under the earth nearly everything is new. It is safe to say that not one per cent of the subterranean passages in our limestone regions have been explored. In Kentucky alone, according to Professor Shaler, there are at least 100,000 miles of caverns that have not filled up. A similar honeycombed formation extends over large parts of Indiana, Illinois, Missouri, Arkansas, and Tennessee. Superb caverns have been found in the Shenandoah Valley of Virginia, in the Black Hills of South Dakota, and in other parts of our country. Very few, even of our best-known caves, have yet been completely explored. There are hundreds, and perhaps thousands, that no man ever has entered. They

are sealed or masked from our observation, and yet have left marks by which their existence can be proved.

CAVE "SIGN."—The surface indications of a cavernous region are easy to read. Take the Ozark Plateau, for example. Anyone traveling cross-country from the Missouri River toward Arkansas will notice that the surface rock mostly is limestone and that it is commonly porous or fissured, being easily "eaten" by the elements. Often he will observe what geologists call vermicular limestone, full of little holes like those that earthworms bore in the soil, or like what "sawyers" bore in pine timber. He will cross some fine rivers, generally very clear, but will marvel at the almost total absence of brooks and spring branches; this even in a country that is distinctly mountainous.

In summer one may travel sometimes for a day in the Ozarks without finding running water. He may come to the perfectly dry bed of a water-course that evidently drains a considerable territory, and his driver will tell him that this "dry fork" carries surface water only for a short time after a heavy rainfall. The real drainage stream flows underground.

When a spring is met in this region it is likely to be a large one. A typical "big spring" boils out of a hillside and fills a crater-like basin sixty to a hundred feet in diameter. Its surface is blue as indigo. The water is so clear that, by immersing your face, you can see the white bottom forty or fifty feet below. The outlet is strong enough to turn a mill, and forms at once a creek navigable by canoes. Such are the St. James Spring on the Meramec, the Round or Blue Spring on the Current River, Bryce's Spring on the Niangua, and Mammoth Spring near the Missouri-Arkansas line.

On wide plateaus, where the drainage is not abrupt, our traveler will see numerous funnel-shaped depressions in the fields, into which sur-

face water either disappears quickly after a rain, or collects in ponds, according to whether the vent of the "sink-hole" is open or has been closed. Often one comes to a place where the fields are fairly pock-marked with such holes.

All this tells a plain story. There are few small springs and brooks because the surface rock is so porous or fissured that rain almost immediately seeps through it to underground channels. The sink-holes are simply old cavern chambers with the roofs fallen in. Generally there are deeper chambers or galleries below them, into which the drainage flows if the sieve or tube in the funnel's neck has not been closed by accident or design. The great springs are outlets of subterranean rivers.

Whenever the underground waters have eroded a channel at a lower level than that which drained the original gallery the latter is left dry and forms an extensive cavern that can be opened for exploration. This is provided that the old passages have not filled up again by a process that will be described hereafter.

Cave Districts.—Some of the caverns already known in the Ozarks are of noble dimensions. The Marble Cave, forty miles from Marionville, Mo., has been traversed for many miles, and to a depth of 400 feet below the surface. One of its vaulted chambers is 350 feet long, 125 feet wide, and 195 feet high, by actual measurement. Three miles away is the exquisitely beautiful Fairy Cave, which is entered through a sink-hole 100 feet deep. There are said to be over a hundred known caves in Stone County alone.

Crossing the Mississippi into southern Illinois, we find a cavernous limestone belt in comparatively level country. Near Burksville is a cavern that is said to have been explored fourteen miles one way and six miles in the opposite direction, without finding either end. It has a lake, and a river in which there are blind fish.

Southern Indiana has scores of caves that contain eyeless fish and crustaceans, beds of niter, epsom salts, great deposits of alabaster, and Indian relics. In the Wyandot Cave is a domed chamber 1,000 feet in circumference and 185 feet high, from the floor of which rises a pyramid to within 50 feet of the roof. In another vast hall is a symmetrical pillar 40 feet high and 75 feet in periphery, rising from a base that is 300 feet around, the whole mass being solid, homogeneous alabaster as white as snow.

The finest cavern district in the world is about the head waters of the Green River, in Kentucky. Here the limestones have a depth of several hundred feet, and hence are peculiarly favorable for the formation of stupendous caverns. Edmonston County by itself has some five hundred caves, one of which, the Mammoth Cave, is certainly the largest that has yet been discovered on the globe. Within a section of about ten square miles, and a thickness of 300 feet, where this gigantic cavern is centered, there are probably more than 200 miles of galleries large enough to permit the passage of a man. The "Long Route" for visitors in the Mammoth Cave, which is mostly quite smooth and easy, takes eight or nine hours of steady walking at an average pace of two miles an hour. One of the domes is 300 feet high. The Mammoth Dome is about 400 feet in length, 150 feet in width, and from 80 to 250 feet high, according to position.

The cave district of the Shenandoah Valley, in Virginia, differs from those hitherto mentioned in that the rock, instead of lying in horizontal strata, is folded and uptilted. This peculiarity limits the Virginia caverns to moderate dimensions, but affords extraordinary bases for the growth of alabaster "cascades" and other fantastic formations of dripstone. Here are the far-famed Caves of Luray, which contain the most weird and beautiful grottoes in the known world.

How Caves are Formed.—No one should try

to explore a cavern until he has learned how these underground passages are formed. To go ignorantly into such places is to lose most of their interesting features and to court disaster.

It is a common error to imagine that our caverns have been caused by earthquakes or by volcanic forces. An earthquake may crack great crevices in the crust of the earth, as at New Madrid, in 1811, and at Charleston, in 1886, but these are very narrow in proportion to their length and depth. It never forms vaulted chambers or smoothly rounded passages.

More numerous are the rifts and chasms left by "faults" in the rock where strata have been folded in the slow shrinkage of mountain-building and then have been pulled apart by a subsidence. These, too, are only narrow fissures, and not caves at all.

A volcano may form a sort of cave with its lava when the fluid mass underneath flows away and leaves an arch of its hardened crust in place. Such action is never found save in volcanic countries.

Hot springs or geysers bore channels of escape from their deep reservoirs to the surface. Where the rock is soluble they may eat out large chambers, but they do not excavate lateral galleries.

There is a class of horizontal caves in the faces of cliffs, very common in the Appalachians and in the Southwest, that are called "rock houses." These always are shallow enough to admit daylight throughout their interiors, and they are dry. Their origin is evident. Where an exposed stratum of very soft rock underlies one of hard and impervious material, on the face of a cliff, the soft stone absorbs water, and when this freezes it is cracked off and disintegrated. The debris is whirled around by the winds and helps to grind out a "room" under the hard ledge that projects like a porch roof overhead. Such places often are used for shelter by man and beast. They are the "robber caves" and "bear dens" of song and story, but true caverns they are not.

Along the sea-coast are many interesting but shallow grottoes that have been pounded out by rocks hurled by the incoming waves, and worn into curious forms by the restless waters themselves. Neither these nor any of the preceding kinds of natural excavations or fissures are extensive enough to rank with the caverns that abound in limestone formations throughout the earth.

Vast subterranean passages and chambers are

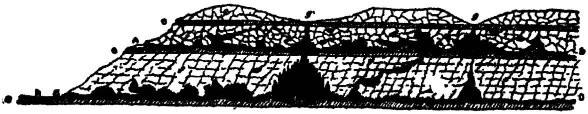


Fig. 188.—Cross section of cavern
A B, upper gallery (ancient); g g, sink-holes; C D, lower gallery (modern); h, stream; A, old mouth of cavern; f f f, limestone; C, present mouth of cavern; e e e, hard rock

formed in limestone by an agency far gentler than any of those mentioned above.

First, there must have been at some time a deciduous forest, shedding, each autumn, a thick layer of leaves. Upon these leaves the rains fall, and their waters absorb from the decaying vegetation charges of carbonic acid (the same gas that is used in soda fountains). This acidulated water, seeping into crevices in the limestone, dissolves out much of the lime and leaves only a shell of the original rock. Thus the cracks in the surface gradually widen and deepen.

When the rainwater reaches an underlying bed of sandstone, or of some other rock that is not easily dissolved by carbonic acid, its downward course is stayed. Then, under pressure from above, it begins eating and cutting a more or less horizontal course along the underground drainage plane. This mining process is hastened by erosion. Whenever there is a crack or fault large enough to admit a considerable rill of water, sand and gravel are car-

ried below, which, being whirled about in a vortex, rapidly cut the walls of the cave bed. Nodules of flint, washed out from the honeycombed rock above, lend powerful aid to this grinding and drilling process. Thus in time a large chamber is excavated below the main fissure and an underground river finds its channel to some exit which may be miles away.

When a cave chamber forms near the surface of the ground its arch or vault may gradually weaken until it can no longer sustain the weight overhead. It collapses, leaving a pit strewn with rubbish that was formerly the dome of the cave. Slowly some of this rubbish is pulverized and washed away. The edge of the pit wears smooth and sloping sides are formed, tapering downward to a common center. The result finally is a funnel-shaped cavity in the earth that we call a sink-hole.

Abysses.—In some districts, as in the cavernous region of Kentucky, these sink-holes, varying greatly in size, may average a hundred to the square mile. Occasionally one will be found that covers several acres and descends gradually to a hundred feet at its throat. The distance thence downward through a pit or dome to the floor below is usually not great, but in some instances exceeds a hundred, or even two hundred, feet. The Devil's Hole, near Fordland, Mo., is so deep that when large logs are tumbled into it they are never heard to strike bottom; but I have not learned of any trustworthy measuring having been done at this place. It is claimed that the famous Rowan Pit in Yorkshire, England, has been descended vertically six hundred feet without finding bottom. How true this may be I do not know. Strange errors have been made by earnest and sincere men in "measuring" pits and caverns. I will quote a remarkable example from Mr. Hovey:

"Eldon Hole . . . is a famous pit in the Peak of Derbyshire, about which Hobbes wrote in Latin

and Cotton in English. The latter thus testifies in verse:

> "'I myself, with half the Peak surrounded,
> Eight hundred, four score and four yards have
> sounded;
> And though of these four score turned back wet,
> The plummet drew and found no bottom yet!'

"In other words, the poet's measurement found no bottom at the astonishing depth of 2,652 feet! Probably Mr. Cotton let the rope coil on the bottom, mistaking the weight of it for that of the plummet—a mistake actually made by a civil engineer in Kentucky, who reported a pit to be 300 feet deep, which afterward was proved to be but 90 feet. Concerning the Eldon Hole, it is further stated that the Earl of Leicester hired a man to descend, who, after going down 750 feet, was drawn up a raving maniac, and died in eight days. Very likely he imitated the Knight of La Mancha, when in the Spanish cave, who ensconced himself on a convenient shelf, and let the rope dangle as far as it might below, while he dreamed the rest of the adventure. At all events when Mr. Lloyd, a member of the Royal Society, took it in hand to sound the bottom of the Eldon Hole, he found it at the exact depth of 186 feet, and told the story in the Transactions of the Society."

When the roof at both ends of a cavern chamber drops in, leaving the central arch intact, the result is a "natural bridge," such as the noted one in Rockbridge County, Virginia, the lower face of which is 160 feet, and the upper surface 215 feet above the water of Cedar Creek. Larger ones are found in other localities.

When both ends of a cavern gallery or long corridor fall in, and the bridge thus formed is very wide, we have a "natural tunnel." I know of one on a fork of the Current River in Missouri, where the stream pierces a mountain ridge. Near the

Clinch River, in Virginia, a creek flows through a great arch for more than half a mile. In Mammoth Cave there is an arcade 4,000 feet long, 100 feet wide, and 45 feet high. If both ends of this hall should fall in there would be another of these natural tunnels.

Fig. 189.—Map of a part of the Mammoth Cave (shaded parts are at low level)

At first sight it seems incredible that such vast excavations could be made by chemical action and erosion. And yet there have been greater ones in former caverns that kept on hollowing out the rock until their roofs could no longer stand the strain.

The debris then being disintegrated and washed away, there remain no traces of the old caverns except ravines or valleys that originally were arched over and were wholly underground. The part that minute agencies and gentle but persistent forces play in building up and reshaping the earth is illustrated by the fact that most of the limestone itself is derived from the remains of very small animals that covered the floors of the ancient seas.

STALACTITES AND STALAGMITES.—Caves are obliterated by other means than by collapse. Strangely enough, the very process that hollows out a cavern has a tendency to fill it up again. Everyone who has visited a limestone cave of any consequence has noticed the stalactites hanging from the ceiling and stalagmites rising from the floor directly beneath them. These are formed in the following manner:

The vault of a cave chamber is seldom dry. Water still seeps very slowly through it. Now, when acidulated water pours through a crevice in little rills it has a cutting and eating effect upon the rock. But where there is no perceptible crack, and it seeps through the room and falls drop by drop, each drop remains long enough upon the ceiling to deposit some of its dissolved lime upon the ceiling in the form of a ring. The next drop leaves another layer, and so on. Thus there is built, at first, a slender, delicate tube of soft lime resembling a pipestem. By and by this tube fills up, and it hardens through crystallization. Thereafter it grows thicker and longer from constant deposits by evaporation on the outside, and it forms what we call a stalactite.

Meantime all those drops that did not evaporate wholly on the ceiling leave the rest of their lime at the points where they strike the floor. Thus there grow upward a series of mamillary concretions or stalagmites rising higher and higher toward the long pendants overhead. In time a stalactite and

a stalagmite will join, forming a pillar. If the seepage from above exudes chiefly through a long fissure, the dripstone will join along this line into a solid partition. In this way small chambers are formed out of large ones, passages are obstructed, defiles are closed, ceilings and floors grow toward each other, until finally a whole cavern may be closed up by the same process that started its excavation.

Dripstone is the general name given to all deposits made by dripping water, regardless of their forms and composition. Originally it is nothing but soft sulphate or carbonate of lime, with perhaps a trace of iron or other metal soluble in carbonic acid. Gradually it hardens into gypsum or alabaster or calcite, as the case may be. Often its crystalline forms are of great beauty, both in structure and in coloration. The shapes that dripstone assumes in stalactites, in pillars, and on cavern walls, are as varied as those in a kaleidoscope, ranging from delicate filigree to baronial ruins, from boiling springs or cascades of water to imitations of animals or grotesque figures suggesting phantasms of mythology.

The thickness of dripstone is a very uncertain measure of the age of a deposit. Limestone rocks vary in composition and in the solubility of their lime. Underground waters vary in their percentage of carbonic acid, from weak solutions to those that effervesce and have an acid taste. The rate of seepage varies. So a stalagmite may grow at the rate of nearly an inch a year, for a time, and afterward less than that in ten or twenty or fifty years.

How to Explore.—Before trying to explore a cavern it is advisable to study the topography of the surrounding country. Note where the main stream of the district lies. Its level determines how deep the cave can possibly go. The thickness of the limestone bed above that level shows the maximum possible altitude of the cave chambers.

Most of the caves that have been explored are entered through a passage into a hillside. Such an opening usually indicates that this was once the drainage outlet of the cave. If no water be running out of it now, the underground stream must have worked a way down through the original cave bed and opened a new gallery below.

A novice should first gain some experience in company with a guide, in some cave that is easily entered. Everybody is nervous on his first expedition underground, unless the course is well known to companions who have been there before. A cavern is the worst of all places to get "rattled" in. When you do start exploring on your own account, take it gradually, until you can bore into the unknown as coolly as you would bite off the end of a cigar.

When a new cave is to be entered, do not go with a large party. They will confuse each other with their reverberating babble, discussions as to the best route will arise, and the larger the party the greater the chance that someone will flunk. Three is a good number: then there are two men to help one who may have got into difficulties.

OUTFIT.—The importance of thoroughly dependable lights is paramount. Big, clumsy lanterns should not be taken; they are always a nuisance when one is climbing or crawling. The best light for cave exploration that I know of is an acetylene lantern with small bail, shaped like a conductor's lantern, giving a 20-candle-power light for five to six hours on three ounces of carbide. It spreads light all around, instead of merely throwing a beam in one direction like a bull's-eye lantern. If one such light is in the party the others may be small acetylene bull's-eye lamps. The best of these has a sparking attachment that lights without matches (but don't leave out the matches), and is fitted with folding handles on the side. The hook and spring attachment used on miners' lamps may

be substituted, but personally I do not like it so well.

Spare carbide to last at least twelve hours should be carried by each man, in air-tight tins specially made for the purpose; and everybody should have a canteen of water, both for the lamp and for his own use, as there is no certainty of finding any in an unexplored cave.

See that the lanterns are in perfect working order. If previously used a good deal, they should be refitted with fresh felt packing, as the old packing may be clogged with carbide dust.

Besides his lantern, every member of the party should carry one or two good hard candles. There is no telling when an accident may happen to a lantern; it may balk, may be crushed, or may be dropped into a pit. The candle is also needed when recharging the lantern.

Matches should be waterproofed, either by dipping in melted paraffin, or in collodion, or in shellac varnish thinned with alcohol. An emergency supply of matches not to be used except when there are no others, should be carried in a waterproof box with cover fitted so it cannot drop off. This match-box ought to have a small swivel or eye attached so it can be fastened to one's belt by a key chain. Then it will stay with you to the death. Inside this box, with the matches, stow a little strip of emery cloth, folded, to strike a match on when you and all your surroundings are sopping wet.

A compass may be useful if the general course of the cave is fairly straight, but in the labyrinths that most caves are contorted into it is of little or no avail. Neither is a pedometer. A pocket aneroid may be useful to indicate one's depth from the surface, but it is by no means necessary.

Wear old clothes, of course. Everything should be of wool, except that the coat should be of conventional hunter's pattern, khaki or duxbak, with plenty of pockets. Such a coat carries all the impedimenta except the lantern, and keeps them stored

away where they will not flop nor stick out to impede one's progress in climbing or in squeezing through narrows. Wear the flaps closed at all times.

The hat should be soft and with narrow brim. Gloves are useful to keep the hands from being lacerated. Shoes should be studded with cone-headed Hungarian nails (*not* calks nor broad hobnails) around the *edges* of heels and soles, including the arch of the foot. This makes them cling better to the rocks. Too many nails defeat the purpose, for they will not "bite" well. Hard steel calks are slippery on rocks.

Waterproofs are an utter nuisance in cave hunting. The wetting you may get will do you no harm at all in the cave air, which is always of uniform temperature. Do not wear a lot of bunchy clothing from dread of cold. You will be exercising all the time in the most exhilarating air you ever breathed. Go slow in entering and emerging from the cave; then there will be no risk of a chill.

Take for granted that the cave will prove to be a labyrinth of three dimensions, far more puzzling than anything you have ever encountered on earth. It may not be so; but most caverns are. There is only one absolutely safe way to explore an unknown cave, so far as not getting lost is concerned, and that is for each member of the party to carry plenty of common white twine, and take his turn as file closer in paying out this twine as he advances. In some places you can buy cord put up in tubes that unreels itself without danger of tangling. Where the going is good there may be no need for the twine; but don't neglect this simple precaution in all parts of the cave where there may be the least doubt of the route back again.

Someone should carry a strong cord for lowering a lantern into pits or gulfs.

In the game pocket of your coat stow a lunch and an emergency ration, along with the small canteen

of water. Somebody should carry a cup, as you may have to catch drip-water. Let another man bear a cold-chisel and a small hammer for collecting specimens, marking passages, and cutting nicks for handhold and foothold. If there is any likelihood of descending into a lower gallery, take about fifty feet of Alpine rope (to be had of some camp outfitters).

Large cavern chambers cannot be illuminated with lanterns. So go provided with strips of magnesium ribbon. Do not try to use this ribbon as a substitute for flash-powder in photographing: it will show the most freakish bolts of lightning in your pictures. Satisfactory interiors, in caves, can only be taken with a wide-angle lens, as the range is nearly always short.

Cave Measurements.—In estimating distances beware of "cave miles." It is almost impossible to keep from overestimating distances in labyrinths underground, unless one trails a cord behind him wherever he goes. A cave mile, when tried by tape-line, generally proves to be only a few hundred yards long. Heights, depths, and widths are also very deceptive by lantern light.

It may be asked, How are heights of cavern domes measured? They used to be "measured" by timing the flight of rockets made for the purpose, but such expedients were very inaccurate. The only easy and reliable way that I know of is by sending up toy balloons with cord attached. There are no draughts in the interior of caves, and this method can be depended on, no matter how high the vault may be.

Descending into Abysses.—Do not be afraid of fire-damp, unless you are going down a sink-hole that may have been sealed at the bottom. The air of a true cave is purer and more invigorating than any to be breathed on earth. One can work with less fatigue in a cave than in the open air.

The chance of finding caverns that no one else has explored is now limited, in our country, mostly

CHAPTER XX

BEE HUNTING

The craft of the bee hunter, although based upon some curious woods lore, is not hard to acquire under proper tutelage. The theory is simple enough. First capture a few wild bees and let them fill up on honey or other bait that has been brought along for the purpose; then liberate them, follow in the direction of their flight as far as you are sure of it, capture and send out more guides, and so on until the tree is reached. In practice, successful bee hunters resort to some shrewd arts unknown in any other branch of wildcraft.

A backwoodsman's way of "lining" bees, when he merely chances upon them, not prepared for regular bee hunting, is to capture one of the insects and fasten to it, or stick into it, a small, downy feather, a bit of straw or thistle-down, or some other light thing by which he can distinguish the insect in its flight; then he liberates it, and follows it as far as he can by sight. The bee, bothered by its strange incumbrance, and finding that it cannot rid itself of the thing by its own exertions, goes home for help. Then the hunter, having secured a few more bees, follows the line of flight as far as he can, sets free another marked bee, and thus proceeds until he either finds the hive or at least gets a clear notion of its whereabouts. Then he, too, goes home, and prepares for bee robbing in earnest.

That sort of thing is accidental. But a regular bee hunter does not depend upon luck at any stage of the game. He goes out looking for bees, and for bees only. He knows where to look, where not to

look, and what to do when he finds the bees, all according to the season of the year and the lay of the land.

Spring.—The easiest time to find a bee-tree is early in the spring, or late in the fall, because then there is no nectar for the bees and they will take kindly to bait; also, because then there are no leaves on the trees to interfere with the hunter's vision. Of course, it is poor policy to rob a beehive in spring, for what honey is left will be old, dark colored, and not so well flavored as new honey; but this is a good time to mark the bee-tree for future attack. The methods for spring and summer hunting are different; so I will describe them in sequence.

In the first warm days of spring, while there still is snow on the ground, a hive may sometimes be located by listening for the humming of the bees in their cleansing flight, and by looking for dead bees on the snow, under likely looking trees, where they have been dropped by workers in cleaning the hive. But, as a rule, it will be necessary to find where the bees are collecting early sweets, or, in default of this, to lure them to bait specially prepared for the purpose.

As soon as the sap of the sugar maple begins to rise, which may be as early as the middle of February if the season is forward, but commonly is later, the bee hunter goes among the maples and birches. Wherever a gash or bruise in the bark lets the sap ooze out, or "bleed," as he calls it, he may find bees at work. The sap flows best on a warm day following a freezing night. A regular bee hunter will purposely wound a number of trees in different localities, in anticipation of this.

Early in March he looks for skunk-cabbage, which, by the way, is not the only malodorous thing that bees frequent at this season. Toward the middle or end of March the willow catkins attract a buzzing throng. In April the beech and some of the maples are in bloom and fragrant with sweets.

Then come the columbine and dicentra (Dutchman's breeches), from which the honey bee gathers pollen only, for its tongue is too short to reach the nectar as the bumblebee's does.

Baiting.—If such scouting trips fail, the hunter will resort to lures. A backwoodsman who has neither honey, nor sirup, nor sugar, with which to prepare bee-bait, will steep corn-cobs for a couple of days in what, by way of euphemism, he calls "sour-bait," or in strong brine scented with anise or bergamot. These he places on stumps in his fields, where the bees are pretty sure to take them for treasure-trove. A surer way to attract them is by roasting honyecomb or beeswax. For this purpose a piece of tin or a flat stone is heated in the fire, and the comb or wax, moistened with water, is placed on it. The chief objection to this method is that it is bothersome to carry the hot rock or tin from place to place.

Bees are fond of certain essential oils, such as oil of anise and oil of bergamot, which, either singly or in combination, may be used as a lure by adding a few drops to a vial of sugar-water. This may be done at any season. Some bee men prefer to take flowers of the particular plant or tree that the bees are favoring at a given time, pack them well down in a wide-mouthed jar, add just enough diluted alcohol (25%) to cover, and let stand a few days. In this way you can make your own essences of buckwheat, goldenrod, clover, etc., with which to dope your sugar-water. The latter is a thin sirup made by dissolving granulated sugar in three times its bulk of water, or clear honey thinned with an equal bulk of warm water, or a mixture of sugar and honey in water. A 4-ounce vial of it is plenty.

The reason why ordinary thick honey will not do so well as the diluted mixture is this: You will wish to judge, from the time of the bees' flight, how far away the bee-tree is. Their time of absence when carrying nectar is pretty accurately

known, for different distances. But honey is much thicker, heavier, and more sticky than the nectar that bees gather from flowers, the latter being little more than sweetened water plus aroma. Consequently it takes the bees longer to fill up on honey, they stagger with it in their flight, and it takes longer to discharge their cargo.

So the hunter will set out a bait of, say, diluted honey to which a drop of oil of anise has been added. Bees will smell such an enticing odor for a mile or more. In any case, the object is first to capture some wild bees as guides. The way to manage them after they are caught is to be described later.

NECTAR.—Early sweets are gathered by bees from the bloom of all kinds of fruit-bearing trees and plants, from violets, hepaticas, and other flowers. In May the busy insects forage on the clematis, dandelion, honey locust, tulip or "yellow poplar." The locust bears nectar only at intervals of several years, but the big blossoms of the tulip tree are commonly rich in it—so rich that sometimes the nectar can be dipped out with a spoon—as well as in pollen, which is a necessity to the bee. That unhappily imported weed among our trees, the ailanthus or "tree of heaven," is another favorite of the bees, despite its ill-smelling blossoms.

Through the summer months there is almost a surfeit of sweets for the honey-maker: boneset, borage, bugloss, white clover, coralberry, figwort, goldenrod, milkweed, motherwort, mustard, rape, sage, Spanish needle, spider-flower, sumac, sunflower, teasel, willow-herb—a legion of others—and, favored of all in forested regions, the cream-colored blossoms of the linden or basswood.

The West has a famous nectar-bearer called the Rocky Mountain bee-plant. In the South, the bees of the lowlands use the cotton plants; those of the mountains, where there is a bewildering variety of "honey-bloom," seek by preference the linden and the delightfully aromatic blossoms of the sourwood.

As summer wanes, the bees turn to the asters, catnip, fireweed, fleabane, heartsease, and other late-blooming plants. Wherever there is a buckwheat field they will be found in their glory. Later they work in the turnip patches. Some of the many species of goldenrod yield nectar until well on in October.

OUTFIT.—The equipment for bee hunting is very simple. You will need a small box or two, same thinned honey or sugar-water (scented or not as you choose), a few pinches of flour in a little box or bag (or, preferably, a small tube of artist's white paint and a camel's-hair brush). A watch, compass, and perhaps an opera glass, should be taken along, particularly if you are an amateur; and do not omit a lunch, for you are likely to be out all day.

As for boxes, a couple of half-pound candy boxes will do; but it is better to make a special one for the purpose. This is merely a light wooden box about four inches cube, without top or bottom, but with a glass slide at the top working in saw-cuts in the sides. About an inch below these saw-cuts, and parallel with them, are narrow strips to support a little feeding tray, which is about an inch and a half wide, just long enough to fit inside the box, and of such height that its top will come within a half inch of the glass slide. Do not use an old cigar box for material, since bees, like other insects, detest the odor of tobacco. Some boxes are made with sliding wooden bottoms, and others are double, hinged together, with a wooden slide between; but the simpler one here described will do very well.

BEE GUIDES.—Now, early in the morning of a warm, still day, go where there are nectar-bearing flowers. The place must be at least a mile, preferably two miles, away from any house where tame bees are kept, or you will be annoyed by them. Few bees go more than two miles from home in search of honey.

Choose an open glade or hillside, or an old field, or a fire-burnt waste where weeds and vines have sprung up, but free from leafy trees and shrubs, so that you can see for a considerable distance all around.

If bees are working here, put a little of your honey bait in the feeding tray of your box, cautiously set the box over the first bee that you find on a flower, and close the bottom with your hand. The bee will buzz up against the glass, and then soon will seek the honey. Now set the box on a stump or other elevation in the midst of a clear space. As stumps are not always to be found where wanted, some bee hunters carry with them a staff pointed at one end and with a bit of shingle tacked to the other end to serve as a platform for the box.

As soon as the bee is hard at work on the honey, approach quickly and withdraw the glass slide. Dust him slightly with flour, or put a bit of paint on his back just large enough to be noticeable, so you can identify him when he returns. Then withdraw to one side, get into a comfortable reclining position, and, if you have an opera glass, get it ready for action.

When the bee has gorged himself he will rise from the bait in half-circles and sudden dodges, generally to one side of the bait, returning toward it, and oscillating back again. He is getting his bearings. Now he mounts higher and higher in an increasing spiral. Then, so suddenly that it takes good eyes or a glass to follow him, he darts off for home. Watch him as far as you can, and note the direction of his flight. He will not go through woods, but over them. If he flies toward a farmhouse, pay no further attention to him, for he is a tame bee. In that case, go somewhere else and begin anew. But if he goes to the big woods, look at your watch and time his absence. You will know him when he returns by the mark that you have put on him.

On an average, a bee flies a mile in five minutes, and he spends about two minutes in the hive, disgorging. Bees vary in their flight, but a good general rule is to subtract two from the number of minutes absent, and divide by ten; the quotient is the number of miles, or the fraction of a mile, from your stand to the bee-tree. The time of the bee's second flight will be a more reliable datum than that of the first, because by that time he will have established his bearings and will go straight to and fro.

The pioneer bee will probably come back alone from his first trip. Let him fill up and depart as before; but now watch the course of his flight very closely, for it will be a "bee-line" for home. His course will be slightly sinuous, but its general direction will be straight for the hive, unless the ground is so rough as to cause contrary air currents, in which case he will seek the lee of woods or the shelter of a ravine, or unless there is a lake or large pond in the way, which he probably will sway around—for some reason known only to themselves, bees dislike to pass over a body of water—so a bee-line is not necessarily a straight line. Pick out some tall or peculiarly topped tree, or other prominent object in line with his course, take its bearings by compass, and study it carefully, so that you may recognize this landmark thereafter.

After two or three trips, your first bee probably will bring some companions with him from the home hive. Capture several more bees, say half a dozen, mark them, and let them go as before. If they all go in the same direction they belong to the same hive. But you may get two or more lines working from the same bait, in which case select the more numerous one, as it is likely to be nearest.

Cross-lining.—When once you get a line of bees working back and forth it is time to bestir yourself. Now you can choose between two schools of bee hunters: those who cross-line from the start, and those who claim that this is a waste of time

and that no cross-lining should be attempted until the hunter has passed beyond the treasure tree and finds the bees back-tracking. I incline to the latter school; but I will describe the working methods of both.

To cross-line at the start; leave some bait at your first stand, take your box, capture a number of bees, cover the top and bottom of the box, to exclude light and thus keep them quiet, and go away at a right angle to the bee-line, about 200 or 300 yards. Here set down your box, uncover, but do not open the top; leave the box alone for a minute or two until the bees recover from their surprise and begin feeding; then liberate them, and note their course as before. This gives you the base of a triangle, the apex of which, where the two lines of flight converge, is near the hollow tree that contains the wild bees' hoard. If you do not see where the lines meet, the hive is beyond your present range of vision.

Whether you do this or not, as soon as you can follow the line for a considerable distance, clean the feeding tray, capture a number of bees in the box, and take it with you as far as you are sure of the course. Then put a little more honey-water in the feeder, and start your bees again. Thus work progressively toward the goal.

HIVES.—Sometimes the kind of tree that the hive is in can be foretold from the color of the insects themselves, which is modified, after a few months' residence, by the nature of the timber: light colored bees in pine, poplar, chestnut; darker ones in oak, beech, maple. But it is not likely that you will find the hive by merely following the bee-line and examining such or such trees along the way. Look for an old squirrel hole or knot-hole where the bees fly in and out.

Not infrequently bee hives are in rock crevices. I remember a hive that was well known for years to nearly everybody in that part of the country, but which had never been disturbed, be-

cause it was deep in the cranny of a big rock ledge that overhung the public road.

Occasionally a hive is found in a fallen tree or in an old stump, but this is exceptional. Bees have trouble enough, as it is, from squirrels, 'coons, bears, and other climbing marauders, to say nothing of men.

In searching, it is well to remember that bee-trees seldom are found far from water.

Back-tracking.—If the bees that you liberate finally turn back on the course, or if they do not return to the bait, it shows that you have passed the hive and must "back-track." Then make two stands close together, only 50 to 100 yards apart, lining them carefully. You may now have two squads of bees flying from opposite directions into the tree. If this fails, take a stand 50 yards off to one side (the distance depends upon how thick the woods are), and examine every tree in the neighborhood with keen scrutiny. Pour out a liberal amount of feed, so as to get a large number of bees at work. If still you do not find the bee-tree, try again in this place a day of two later, or whenever the weather is favorable.

Marking the Tree.—In settled regions, where statute-law prevails, a hive of bees in a tree belongs to the owner of the soil, unless a former owner proves and reclaims them. In the wilderness, by law of the woods, ownership is to the first comer who makes a blaze on the bark and cuts or pencils his initials on it. Anyone else meddling with the treasure, unless it be claimed in time by the owner of the land himself, is a trespasser, like the interloper who sets traps along another trapper's line.

Having found a bee-tree, and marked it, then, unless you are very well acquainted with the woods, mark your trail outward with bush-signs; otherwise you may easily miss it on your return.

Robbing the Hive.—Now you are ready to declare war. Men who have had much experience

with bees disdain to wear armor; but I would not advise a novice to emulate their boldness. Get a broad-brimmed hat, say a farmer's straw hat, and fasten to it a head-net of mosquito bar long enough to come well down over the shoulders. A pair of long gloves or gauntlets is needed. Cut two sticks five or six feet long, and bind to one end of each a ball of cotton about as large as a hen's egg. Soak these cotton balls in melted sulphur. Get a sharp axe, and some pails to receive the honey; also a lantern, for your burglarizing is to be done at night. If you are not a good axeman, take with you a man who is.

When you reach the tree, decide which way it should be thrown, and attack it on that side. The bees will not disturb a man while he is felling the tree, as they do not realize what is going on. When the tree is almost ready to fall, put on your mask and gloves. Button the former under your coat, or draw it under your suspenders. Tie your trousers round the ankles, and the gauntlets round your wrists.

A companion should light one of the sulphur balls and have it ready; if the tree is hollow at the butt, he should light both balls. When the tree falls he must quickly apply one of the burning sticks to the bees' doorway, and the other to the hole in the butt, if there is one. The fumes will stupify the now angry insects or at least enough of them to make the work easier.

Chop into the tree until you have located the honey. It is now that the fun begins, for the bees understand by this time that they are being robbed, and the able-bodied ones will pounce upon the offenders, perhaps rushing upon the axeman in a mass so thick that he cannot see through his veil and must brush the fierce little warriors away. On a cold night they will be less active than if the weather is warm.

Having found the honey, cut through the trunk both above and below it, split out the slab, and

thus expose the hoard, being careful not to "bleed" the comb. The bees will now stop fighting and will bend every energy to the work of carrying away all of the honey that they can, storing it in some hastily chosen retreat. You now may help yourself without fear of renewed attack.

Backwoodsmen, when they have no sulphur, use a smudge of punky wood, the acrid smoke of which suffocates the bees or renders them helpless for the time. They take the punk from a log or stump that is rotten enough to break easily in the hands and dry it near the fire. It will not blaze, but neither will it go out. It burns slowly and will give out a dense smoke for several hours. Of course, it kills many bees, and such a method should never be employed except in the far-back wilderness when there is downright need of something to take the place of sugar. Woodsmen who have no mosquito netting sometimes smear themselves with tobacco juice, or with water in which tobacco stems have been steeped, to protect them against stings. In any case they take chances boldly. Bees respect courage, but are quick to detect a wincing timidity and give it its deserts.

If, in spite of precautions, you are stung, apply some honey to the spot. Wet clay, oil of sassafras, ammonia, or onion juice, will relieve the pain and swelling; but honey is at hand, and it is about as good a remedy as any.

If you wish to capture the bees themselves, fix the broodcombs (those containing pollen or "bee-bread") the right distance apart in a bucket or basket, and set this to one side. The bees will collect about them, after their panic is over, and the next evening, when darkness begins to fall, they may be carried home. There are better ways, described in bee-keeping books, but they call for special appliances.

HONEY.—The amount of honey in a tree may vary from almost nothing to 100 pounds or more. There is record of 264 pounds being taken from

one tree. Bees work with great zeal where there is a good supply of nectar, and will fill a hive in a short time.

Basswood bloom may be placed at the head of honey-producing plants. The apiarist, Root, says that during a period of twenty-two years he never knew basswood to fail to yield nectar, the shortest season yielding for three days, and the longest twenty-nine. In one of his hives the bees stored 66 pounds of basswood honey in three days. Ten pounds a day was the best recorded from clover.

John Burroughs has stated that there is no difference in flavor between wild honey and tame. Of course there is no difference in regions where wild and tame bees gather nectar from the same sources; but in the wilderness, where bees can forage only on the blossoms of wild plants and trees, with no access to fields and orchards, the honey has a distinct flavor, or flavors, of its own, as different from that of commercial honey as the flavor of pure, old-fashioned maple sugar is from that of the modern adulterated or "refined" article. To my taste, the honey of the wilderness is as much to be preferred as is the honest, kettle-boiled sugar of "the bush."

The bouquet of honey varies, of course, according to the kind of nectar gathered by its makers. The minty flavor of the linden is quite distinct from sourwood. Anyone can tell buckwheat honey from that which comes from the clover field. As a rule, wild honey has a pungent taste, not so cloyingly sweet as tame honey, and nearly always it is darker colored, even if the hive is new.

Honey gathered from the bloom of rhododendron or mountain laurel, or from the catalpa or catawba trees, is more or less poisonous to human beings. Root says that it causes symptoms similar to those exhibited by men who are dead drunk; or, in less violent cases, a tingling all over, indistinct vision (caused by dilation of the pupils), an empty, dizzy feeling of the head ,and an intense nausea that is not relieved by vomiting. The effects may not wear

off for two or three days. We recall that the Ten Thousand of Xenophon were made ill by laurel honey. However, I doubt if anywhere in the world there is a more luxuriant bloom of laurel and of rhododendron than where I live in the Great Smoky Mountains, and yet I have not heard of a single case of poisoned honey in this region. Doubtless this is due to the profusion of other nectar-bearing trees and plants. Bees will not work on laurel when there is plenty of basswood and tulip and sourwood, which bloom in the same months.

BEESWAX.—Wax is a valuable commodity in the backwoods. To prepare it, break up the honeycomb, press out the honey, then boil the comb until melted in a small quantity of water, squeeze it through coarsely woven cloth, and cool it in molds.

THE SPORT OF BEE HUNTING.—There is an element of luck in bee hunting, and a spice of small adventure, that entitle it to rank among field sports. One must match his wits against the superior agility of the game; he must keep his eyes skinned, follow a long chase, and risk the stings of conflict if he would enjoy the sweets of victory.

The most unlucky thing that can happen is to spend half a day pursuing bees and then line them up in some farmer's hives. As Robinson's "Uncle Jerry" said: "I've lined bees nigh onto three mile, an' when a feller 's done that, an' fetches up agin a tame swarm in someb'dy's do' yard, it makes him feel kinder wamble-cropped."

CHAPTER XXI

EDIBLE PLANTS OF THE WILDERNESS

There is a popular notion that our Indians in olden times varied their meat diet with nothing but wild roots and herbs. This, in fact, was the case only among those tribes that pursued a roving life and had no settled abodes, such as the "horse Indians" and "diggers" of the Far West—and not all of them. The "forest Indians" east of the Mississippi and south of the Great Lakes, particularly such nations as the Iroquois and Cherokees, lived in villages and cultivated corn, beans, squashes, pumpkins, and tobacco. Still, wild plants and roots often were used by these semi-agricultural peoples, in the same way that garden vegetables are used by us, and, in time of famine, or invasion, they were sometimes almost the sole means of sustenance.

To-day, although our wild lands, such as are left, produce all the native plants that were known to the redmen, there is probably not one white hunter or forester in a thousand who can pick out half of the edible plants of the wilderness, nor who would know how to cook them if such were given to him. Nor are many of our botanists better informed. Now it is quite as important, in many cases, to know how to cook a wild plant as it is to be able to find it, for, otherwise, one might make as serious a mistake as if he ate the vine of a potato instead of its tuber, or a tomato vine instead of the fruit.

Take, for example, the cassava or manioc, which is still the staple food of most of the inhabitants of tropical America and is largely used elsewhere. The root of the bitter manioc, which is used with the same impunity as other species, contains a milky sap

that is charged with prussic acid and is one of the most virulent vegetable poisons known to science. The Indians somehow discovered that this sap is volatile and can be driven off by heat. The root is cleaned, sliced, dried on hot metal plates or stones, grated, powdered, the starch separated from the meal, and the result is the tapioca of commerce, or farina, or Brazilian arrowroot, as may be, which we ourselves eat, and feed to our children and invalids, not knowing, perchance, that if it had not been for the art of a red savage, the stuff taken into our stomachs would have caused sudden death.

Another example, not of a poisonous but of an extremely acrid root that the Indians used for bread, and which really is of delicious flavor when rightly prepared, in the common Indian turnip. Every country schoolboy thinks he knows all about this innocent looking bulb. He remembers when some older boy grudgingly allowed him the tiniest nibble of this sacred vegetable, and how he, the recipent of the favor, started to say "Huh! 'tain't bad"—and then concluded his remark with what we good, grown-up people utter when we jab the black-ink pen into the red-ink bottle!

However, not all of our wild food-plants are acrid or poisonous in a raw state, nor is it dangerous for any one with a rudimentary knowledge of botany to experiment with them. Many are easily identified by those who know nothing at all of botany. I cannot say that all of them are palatable; but most of them are, when properly prepared for the table. Their taste in a raw state, generally speaking, is no more a criterion than is that of raw beans or asparagus.

It goes without saying that this chapter and the one that follows are not written for average campers—townfolk mostly, who know almost nothing about our wild flora. They are for the more daring sort who go far from the beaten trail, fend for themselves, and owe it to themselves to study matters of this kind before venturing into inhospitable

regions. I have in mind more than one example of extreme suffering, and even of tragedy, that might have been averted by such precaution. Besides, there is a great number of people on this continent who spend a good part of their lives far back in the woods, where cultivated vegetables are hard to get. Having myself "lived the life," I know how insistent grows the craving for green stuff to vary the monotonous diet, and how profitable as well as pleasant is a little amateur botanizing with a pocket guide, such as Schuyler Mathews's *Field Book of American Wild Flowers,* which suffices to identify most of the plants on the following lists.

I have been much amused, by way of variety, at the attitude of a few skeptics who seem to doubt that the writer knows what he is talking about. One of my correspondents even wrote to inquire whether I "had any personal experience in eating any of these plants!" I suppose he inferred from my citations of authorities here and there that the whole thing was cribbed. It is not fashionable nowadays, I know, for writers who seek popularity to quote directly from others, or even to acknowledge indebtedness for ideas that they appropriate through paraphrasis. However, I am old-fashioned enough to give credit where credit is due, whenever I can identify the one from whom I first got a fact or idea that to me was new. In the following catalogue my citation of an authority does not mean, then, that I have not tried the thing for myself, although in some cases that is so. During the years that I have lived in the woods I have tested a great variety of wild "roots and yarbs"—tried them in my own stomach; otherwise I would not have written a line on the subject. Here is a rather odd example, taken from my notebook under date of May 10, 1910, at which time I was boarding with a native family on upper Deep Creek, Swain County, North Carolina:

Mrs. Barnett to-day cooked us a mess of greens of her own picking. It was an *olla podrida* consist-

ing of (1) lamb's quarters, (2) poke shoots, (3) sheep sorrel, (4) dock, (5) plantain, (6) young tops of "volunteer" potatoes, (7) wild mustard, (8) cow pepper. All of these ingredients were boiled together in the same pot, with a slice of pork, and the resulting "wild salat," as she called it, was good. This is the first time I ever heard of anyone eating potato tops; but a hearty trial of them has proved that the tops of young Irish potatoes, like the young shoots of poke, are wholesome and of good flavor, whereas it is well known that the mature tops of both plants are poisonous.

I am told that the young leaves of sweet potato vines "make an excellent spinach."

To give a detailed account of all the edible wild plants of the United States and Canada, with descriptions and illustrations sufficing to identify them, would require by itself a book as large as this. I have only space to give the names and edible properties of those that I know of which are native to, or, as wild plants, have become naturalized in the region north of the southern boundary of Virginia and east of the Rocky Mountains. Besides those mentioned below, there are others which grow only in the southern or western states, among the more important being the palmetto, palm, yam, cacti, Spanish bayonet, mesquite, wild sago or coontie, tule plant, western camass, kouse root, bread root, screw bean, pimple mallow, manzañita, piñons, juniper nuts, many pine seeds, squaw berry, lycium berry—but the list is long enough. Those who wish further details should examine the publications of the U. S. Department of Agriculture, and especially those of one of its officers, Mr. F. V. Coville, who has made special studies in this subject.

I have given the botanical name of every plant cited herein, because without it there would be no guarantee of identification. The nomenclature adopted is that of Britton and Brown in their *Illustrated Flora of the Northern States and Canada* (Scribner's Sons, New York), which, as it con-

tains an illustration of every plant, is of the first assistance to an amateur in identifying. Wherever Gray's nomenclature differs, it is added in parentheses.

The months named under each plant are those in which it flowers, the earlier month in each case being the flowering month in the plant's southernmost range, and the later one that of the northernmost. In the case of wild fruits, the months are those in which the fruit ripens.

It is necessary to remember that most of the edible plants become tough and bitter when they have reached full bloom.

SUBSTANTIAL FOODS

Acorns.—The eastern oaks that yield sweet mast are the basket, black jack, bur, chestnut, overcup, post, rock chestnut, scrub chestnut, swamp white, and white oaks, the acorns of chestnut and post oaks being sweetest; those producing bitter mast are the black, pin, red, scarlet, shingle, Spanish, water, and willow oaks; of which the black and water oak acorns are most astringent.

None of these can be used raw, as human food, without more or less ill effect from the tannin contained. But there are tribes of western Indians who extract the tannin from even the most astringent acorns and make bread out of their flour. The process varies somewhat among different tribes, but essentially it as as follows:

The acorns are collected when ripe, spread out to dry in the sun, cracked, and stored until the kernels are dry, care being taken that they do not mold. The kernels are then pulverized in a mortar to a fine meal, with frequent siftings to remove the coarser particles, until the whole is ground to a fine flour, this being essential. The tannin is then dissolved out by placing the flour in a filter and let-

ting water percolate through it for about two hours, or until the water ceases to have a yellowish tinge. One form of filter is contrived by laying a coarse, flat basket or strainer on a pile of gravel with a drain underneath. Rather fine gravel is now scattered thickly over the bottom and up the sides of the strainer, and the meal laid thickly over the gravel. Water is added, little by little, to set free the tannin. The meal is removed by hand as much as possible, then water is poured over the remainder to get it together, and thus little is wasted. The meal by this time has the consistency of ordinary dough.

The dough is cooked is two ways: first, by boiling it in water as we do corn-meal mush, the resulting porridge being not unlike yellow corn-meal mush in appearance and taste; it is sweet and wholesome, but rather insipid. The second mode is to make the dough into small balls, which are wrapped in green corn leaves. These balls are then placed in hot ashes, some green leaves of corn are laid over them, and hot ashes are placed on the top, and the cakes are thus baked.

(Coville, *Contrib. to U. S. Herbarium,* VII. No. 3.—Palmer, in *Amer. Naturalist,* XII, 597. Another method, used by the Pomo Indians, who add 5 per cent. of red earth to the dough, is described by J. W. Hudson in the *Amer. Anthropologist*, 1900, pp. 775-6.)

Nuts.—Among the Cherokees, and also in Italy and in Tyrol, I have eaten bread made from chestnuts. The Cherokee method, when they have corn also, is to use the chestnuts whole, mixing them with enough corn-meal dough to hold them together, and then baking cakes of this material enclosed in corn husks, like tamales. The peasants of southern Europe make bread from the meal of chestnuts alone—the large European chestnut, of course, being used. Such bread is palatable and nutritious, but lies heavily on one's stomach until he becomes accustomed to it.

Our Indians also have made bread from the kernels of buckeyes. These, in a raw state, are poisonous, but when dried, powdered, and freed from their poison by filtration, like acorns, they yield an edible and nutritious flour. The method is first to roast the nuts, then hull and peel them, mash them in a basket with a billet, and then leach them. The resulting paste may be baked, or eaten cold.

Hazel nuts, beech nuts, pecans, and wankapins may be used like chestnuts. The oil expressed from beech nuts is little inferior to the best olive oil for table use, and will keep sweet for ten years. The oil from butternuts and black walnuts used to be highly esteemed by the eastern Indians either to mix with their food, or as a frying fat. They pounded the ripe kernels, boiled them in water, and skimmed off the oil using the remaining paste as bread. Hickory nut oil was easily obtained by crushing the whole nuts, precipitating the broken shells in water, and skimming off the oily "milk," which was used as we use cream or butter. The nut of the ironwood (blue beech) is edible.

The kernel of the long-leaved pine cone is edible and of an agreeable taste. Many western pines have edible "nuts." The acridity of pine seeds can be removed by roasting.

KIND	Protein per ct.	Fat per ct.	Carbo-hydrates per ct.	Ash per ct.	Fuel Value per lb. calories
Beechnut	21.8	49.9	18.0	3.7	2,740
Butternut	27.9	61.2	3.4	3.0	3,370
Chestnut, dry ..	10.7	7.8	73.0	1.4	1,840
Hickory nut	15.4	67.4	11.4	2.1	3,345
Peanut	29.8	43.5	17.1	2.2	2,610
Pecan	12.1	70.7	12.2	1.6	3,300
Pine nut, Piñon	14.6	61.9	17.3	2.8	3,205
Walnut	18,2	60.7	16.0	1.7	3,075
By comparison:					
Beef, r'd steak .	19.8	13.6	0.0	1.1	950
White bread....	9.2	1.3	53.1	1.1	1,215

All nuts are more digestible when roasted than when eaten raw.

ARROWHEAD, BROAD-LEAVED. Swan or Swamp Potato. *Sagittaria latifolia* (*S. variabilis*). In shallow water; ditches. Throughout North America, except extreme north, to Mexico. *July-Sep.*

Tuberous roots as large as hens' eggs, were an important article of food among Indians. Roots bitter when raw, but rendered sweet and palatable by boiling. Excellent when cooked with meat. Indians gather them by wading and loosening roots with their feet, when the tubers float up and are gathered. Leaves acrid.

ARUM, GREEN ARROW. *Peltandra Virginica* (*P. undulata, Arum Virginicum*). Swamp or shallow water. Me. and Ont.. to Mich., south to Fla, and La. *May-June.*

Rootstock used by eastern Indians for food, under the name of *Taw-ho.* Roots very large; acrid when fresh. The method of cooking this root, and that of the Golden Club, is thus described by Captain John Smith in his *Historie of Virginia* (1624), p. 87: "The chiefe root they haue for food is called *Tockawhoughe.* It groweth like a flagge in Marishes. In one day a Salvage will gather sufficient for a week. These roots are much of the greatnesse and taste of Potatoes. They vse to cover a great many of them with Oke leaues and Ferne, and then cover all with earth in the manner of a Cole-pit [charcoal pit]; over it, on each side, they continue a great fire 24 houres before they dare eat it. Raw it is no better than poyson, and being roasted, except it be tender and the heat abated, or sliced and dryed in the Sunne, mixed with sorrell and meale or such like, it will prickle and torment the throat extreamely, and yet in sommer they vse this ordinarily for bread."

ARUM, WATER. WILD CALLA. *Calla pallustris.* Cold bogs. Nova Scotia to Minn., south to Va., Wis., Iowa. *May-June.*

"Missen bread is made in Lapland from roots

of this plant, which are acrid when raw. They are taken up in spring when the leaves come forth, are extremely well washed, and then dried. The fibrous parts are removed, and the remainder dried in an oven. This is then bruised and chopped into pieces as small as peas or oatmeal, and then ground. The meal is boiled slowly, and continually stirred like mush. It is then left standing for three or four days, when the acridity disappears." (Lankester.)

BROOM-RAPE, LOUISIANA. *Orobanche Ludoviciana* (*Aphyllon L.*). Sandy soil. Ill. to Manitoba, south to Texas, Ariz., Cal. *June-Aug.*

"All the plant except the bloom grows under ground, and consequently nearly all is very white and succulent. The Pah Utes consume great numbers of them in summer. . . .Being succulent they answer for food and drink on these sandy plains, and, indeed, are often called sand-food." (Palmer.)

BULRUSH, GREAT. Mat-rush. Tule-root. *Scirpus lacustris.* Ponds and swamps. Throughout North America: also in Old World. *June-Sep.*

Roots resemble artichokes, but are much larger. Eaten raw, they prevent thirst and afford nourishment. Flour made from the dried root is white, sweet and nutritious. A great favorite with the western Indians, who pound the roots and make bread of them. When the fresh roots are bruised, mixed with water, and boiled, they afford a good sirup.

CAMASS, EASTERN. Wild Hyacinth. *Quamasia hyacynthia* (*Camassia Fraseri*). In meadows and along streams. Pa. to Minn., south to Ala. and Texas. *Apr.-May.*

Root is very nutritious, with an agreeable mucilaginous taste.

GOLDEN CLUB. *Orontium aquaticum.* Swamps and ponds. Mass. to Pa., south to Fla. and La., mostly near coast. *Apr.-May.*

The *Taw-kee* of coast Indians who liked the dried seeds when cooked like peas. The raw root is acrid, but becomes edible when cooked like arrow-arum.

GRASS, DROP-SEED. Sand Drop-seed. *Sporobolus cryptandrus.* Also Barnyard or Cockspur Grass (*Panicum Crusgalli*).

When the seeds, which are gathered in great quantities by western Indians, are parched, ground, mixed with water or milk and baked or made into mush, they are of good flavor and nutritious. Also eaten dry.

GRASS, PANIC. *Panicum*, several species.

The ripe seeds are collected, like the above, cleaned by winnowing, ground into flour, water added and the mass is kneaded into hard cakes, which, when dried in the sun are ready for use. Also made into gruel and mush.

GRASS, FLOATING MANNA *Panicularia fluitans* (*Glyceria fl.*).

The seeds are of agreeable flavor and highly nutritious material for soups and gruels.

GREENBRIER, BRISTLY. Stretch-berry. *Smilax Bona-nox.* Thickets. Mass. and Kansas, south to Fla. and Texas. *Apr-July.*

The large, tuberous rootstocks are said to have been used by the Indians, who ground them into meal and made bread or gruel of it.

In the South a drink is made from them.

GREENBRIER, LONG-STALKED. *Smilax Pseudo-China.* Dry or sandy thickets. Md. to Neb., south to Fla. and Texas. *March-Aug.*

Bartram says that the Florida Indians prepared from this plant "a very agreeable, cooling sort of jelly, which they call *conte* [not to be confounded with coontie or wild sago]; this is prepared from the root of the China brier (*Smilax Pseudo-China*) . . They chop the roots in pieces which are afterwards well pounded in a wooden mortar, then being mixed with clean water, in a tray or trough, they strain it through baskets. The sediment, which settles to the bottom of the second vessel, is afterwards dried in the open air, and is then a very fine reddish flour or meal. A small quantity of this, mixed with warm water and sweetened with honey,

when cool, becomes a beautiful, delicious jelly, very nourishing and wholesome. They also mix it with fine corn flour, which being fried in fresh bear's oil makes very good hot cakes or fritters."

GROUND-NUT. Wild Bean. Indian Potato. *Apios Apios* (*A. tuberosa*). Moist ground. New Bruns. to Fla., west to Minn. and Kan., south to La. *July-Sep.*

This is the famous *hopniss* of New Jersey Indians, the *saagaban* of the Micmacs, *openauk* of Virginia tribes, *scherzo* of the Carolinas, *taux* of the Osages, and *modo* of the Sioux, under one or other of which names it is frequently met by students of our early annals. "In 1654 the town laws of Southampton, Mass., ordained that if an Indian dug ground-nuts on land occupied by the English, he was to be set in the stocks, and for a second offence, to be whipped." The Pilgrims, during their first winter, lived on these roots.

The tubers vary from the size of cherries to that of a hen's egg, or larger. They grow in strings of perhaps 40 together, resembling common potatoes in shape, taste, and odor. When boiled they are quite palatable and wholesome. The seeds in the pod can be prepared like common peas.

INDIAN TURNIP. Jack-in-the-Pulpit. *Arisaema triphyllum* (*Arum triphyllum*). Moist woods and thickets. Nova Scotia to Florida, west to Minn., Kan., La. *April-June.* Fruit ripe, *June-July.*

The root of this plant is so acrid when raw that, if one but touch the tip of his tongue to it, in a few seconds that unlucky member will sting as if touched to a nettle. Yet it was a favorite bread-root of the Indians. I have found bulbs as much as 11 inches in circumference and weighing half a pound.

Some writers state that the acridity of the root is destroyed by boiling, while others recommend baking. Neither alone will do. The bulb may be boiled for two hours, or baked as long, and, while the outer portion will have a characteristically

pleasant flavor, half potato, half chestnut, the inner part will still be as uneatable as a spoonful of red pepper. The root should either be roasted or boiled, then peeled, dried, and pounded in a mortar, or otherwise reduced to flour. Then if it is heated again, or let stand for a day or two, it becomes bland and wholesome, having been reduced to a starchy substance resembling arrowroot. Even if the fresh root is only grated finely and let stand exposed to air until it is thoroughly dry, the acridity will have evaporated with the juice.

The roots may be preserved for a year by storing in damp sand.

It is said that the Indians also cooked and ate the berries.

LILY, TURK'S-CAP. *Lilium superbum.* Meadows and marshes. Me. to Minn., south to N. C. and Tenn. *July-Aug.*

LILY, WILD YELLOW. Canada Lily. *Lilium Canadense.* Swamps, meadows and fields. Nova Scotia to Minn., south to Ga., Ala., Mo., *June-July.*

"Both of these lilies have fleshy, edible bulbs. When green they look and taste somewhat like raw green corn on the ear. The Indians use them, instead of flour, to thicken stews, etc." (Thoreau.)

LILY, YELLOW POND. Spatter-dock. *Nymphaea advena (Nuphar ad.).* Ponds and slow streams. Nova Scotia to Rocky Mts., south to Fla., Texas, Utah. *Apr.-Sep.*

The roots, which are one or two feet long, grow four or five feet under water, and Indian women dive for them. They are very porous, slightly sweet, and glutinous. Generally boiled with wild fowl, but often roasted separately. Muskrats store large quantities for winter use, and their houses are frequently robbed by the Indians. The pulverized seeds of the plant are made into bread or gruel, or parched and eaten like popcorn.

NELUMBO, AMERICAN. Wankapin or Yoncopin. Water Chinquapin. *Nelumbo lutea.* Ponds and

swamps. Locally east from Ontario to Fla., abundant west to Mich., Okla., La. *July-Aug.*

Tubers of root somewhat resemble sweet potatoes, and are little inferior to them when well boiled. A highly prized food of the Indians. The green and succulent half-ripe seed-pods are delicate and nutritious. From the sweet, mealy seeds, which resemble hazel nuts, the Indians made bread, soups, etc. The "nuts" were first steeped in water, and then parched in sand to easily extricate the kernels. These were mixed with fat and made into a palatable soup, or were ground into flour and baked. Frequently they were parched without steeping, and the kernels eaten thus.

ORCHIS, SHOWY. *Orchis spectabilis.* Rich woods. New Brunsw. to Minn., south to Ga., Ky., Neb. *Apr.-June.*

"One of the orchids that springs from a tuberous root, and as such finds favor with the country people [of the South] in the preparation of a highly nourishing food for children." (Lounsberry.)

PEANUT, HOG. Wild peanut. *Falcata comosa* (*Glycine comosa*). Moist thickets. New Brunsw. to Fla., west to Lake Superior, Neb., La. *Aug-Sep.*

"The underground pod has been cultivated as a vegetable." (Porcher.)

POTATO, PRAIRIE. Prairie turnip. Indian or Missouri Breadroot. The *pomme blanche* of the voyageurs. *Psoralea Esculenta.* Prairies. Manitoba and N. Dak. to Texas. *June.*

The farinaceous tuber, generally the size of a hen's egg, has a thick, leathery envelope, easily separable from the smooth internal parts, which become friable when dry and are readily pulverized, affording a light, starchy flour, with sweetish, turnip-like taste. Often sliced and dried by the Indians for winter use. Palatable in any form.

RICE, WILD. *Zizania aquatica.* Swamps. New Brunsw. to Manitoba, south to Fla., La., Texas. *June-Oct.*

The chief farinaceous food of probably 30,000 of

our northern Indians, and now on the market as a breakfast food. The harvesting is usually done by two persons working together, one propelling the canoe, and the one in the stern gently pulling the plants over the canoe and beating off the ripe seed with two sticks. The seed, when gathered, is spread out for a few hours to dry, and is then parched in a kettle over a slow fire for half an hour to an hour, meanwhile being evenly and constantly stirred. It is then spread out to cool. After this it is hulled by putting about a bushel of the seed into a hole in the ground, lined with staves or burnt clay, and beating or punching it with heavy sticks. The grains and hulls are separated by tossing the mixture into the wind from baskets. The grain will keep indefinitely.

Before cooking, it should have several washings in cold water to remove the smoky taste. It is cooked with game, or as gruel (boil 35 minutes), or made into bread, or merely eaten dry. Its food value is equal to that of our common cereals. "An acre of rice is nearly or quite equal to an acre of wheat in nutriment." (For details see *Bulletin No.* 50 of the Bureau of Plant Industry, U. S. Dep't. of Agriculture.)

SILVERWEED. Wild or Goose Tansy. Goose-grass. *Potentilla Anserina.* Shores and salt meadows, marshes and river banks. Greenland to N J., west to Neb.; Alaska, south along Rocky Mts. to N. Mex. and Cal. *May-Sep.*

Roots gathered in spring and eaten either raw or roasted. Starchy and wholesome. When roasted or boiled their taste resembles chestnuts.

SUNFLOWER. *Helianthus,* many species. Prairies. etc. *July-Sep.* "The seeds of these plants form one of the staple articles of food for many Indians, and they gather them in great quantities. The agreeable oily nature of the seeds renders them very palatable. When parched and ground they are highly prized, and are eaten on hunting excursions. The meal or flour is also made into thin cakes and

baked in hot ashes. These cakes are of a gray color, rather coarse looking, but palatable and very nutritious. Having eaten of the bread made from sunflowers, I must say that it is as good as much of the corn bread eaten by whites." (Palmer.)

The oil expressed from sunflower seeds is a good substitute for olive oil.

VALERIAN, EDIBLE. Tobacco-root. *Valeriana edulis*. Wet open places. Ontario to B. C., south to O., Wis., and in Rocky Mts. to N. Mex and Ariz. *May-Aug*.

"I ate here, for the first time, the *kooyah* or tobacco-root (*valeriana edulis*), the principal edible root among the Indians who inhabit the upper waters of the streams on the western side of the [Rocky] mountains. It has a very strong and remarkably peculiar taste and odor, which I can compare to no other vegetable that I am acquainted with, and which to some persons is extremely offensive. . . To others, however, the taste is rather an agreeable one, and I was afterwards always glad when it formed an addition to our scanty meals. It is full of nutriment. In its unprepared state it is said by the Indians to have very strong poisonous qualities, of which it is deprived by a peculiar process, being baked in the ground for about two days." (Fremont, *Exploring Expedition*, 1845, p. 135.)

POT-HERBS AND SALADS

All of the plants hitherto mentioned are native to the regions described. In the following list will be found many that are introduced weeds; but a considerable proportion of these foundlings may now be seen in clearings and old burnt tracts in the woods, far from regular settlements. Directions for cooking greens are given in Vol. I., pp. 369-371.

ADDER'S-TONGUE, YELLOW. Dog's-tooth Violet. *Erythronium Americanum*. Moist woods and thickets. Nova Scotia to Minn., south to Fla., Mo., Ark. *Mar.-May*.

Sometimes used for greens.

BEAN, WILD KIDNEY. *Phaseolus polystachyus*

(*P. perennis*). Thickets. Canada to Fla., west to Minn., Neb., La. *July-Sep.*

Was used as food by the Indians; the Apaches eat it either green or dried.

BELLWORT. *Uvularia perfoliata.* Moist woods and thickets. Quebec and Ont. to Fla. and Miss. *May-June.*

"The roots of this and other species of *Uvularia* are edible when cooked, and the young shoots are a good substitute for asparagus." (Porcher.)

BROOKLIME, AMERICAN. *Veronica Americana.* Brooks and swamps. Anticosti to Alaska, south to Pa., Neb., N. Mex., Cal. *Apr-Sep.*

"A salad plant equal to the watercress. Delightful in flavor, healthful, anti-scorbutic." (*Sci. Amer.*)

BURDOCK, GREAT. Cockle-bur. *Arctium Lappa.* Waste places. New Brunsw. to southern N. Y., and locally in the interior. Not nearly so widely distributed as the smaller common burdock (*A. minus*). *July-Oct.*

A naturalized weed, so rank in appearance and odor that nothing but stark necessity could have driven people to experiment with it as a vegetable. Yet, like the skunk cabbage, it is capable of being turned to good account. In spring, the tender shoots, when peeled, can be eaten raw like radishes, or, with vinegar, can be used as a salad. The stalks cut before the flowers open, and stripped of their rind, form a delicate vegetable when boiled, similar in flavor to asparagus. The raw root has medicinal properties, but the Japanese eat the cooked root, preparing it as follows: The skin is scraped or peeled off, and the roots sliced in long strips, or cut into pieces about two inches long, and boiled with salt and pepper, or with soy, to impart flavor; or the boiled root is mashed, made into cakes, and fried like oyster plant.

CHARLOCK. Wild Mustard. *Brassica arvensis* (*B. Sinapistrum*). Fields and waste places. Naturalized everywhere. *May-Nov.*

Extensively used as a pot-herb; aids digestion.

CHICKWEED. *Alsine media.* (*Stellaria m.*). Waste places, meadows, and woods. Naturalized; common everywhere. *Jan-Dec.*

Used like spinach, and quite as good.

CHICORY. Wild Succory. *Chichorium Intybus.* Roadsides, fields, and waste places. Nova Scotia to Minn., south to N. C. and Mo. *July-Oct.*

All parts of the plant are wholesome. The young leaves make a good salad, or may be cooked as a pot-herb like dandelion. The root, ground and roasted, is used as an adulterant of coffee.

CLOVER. *Trifolium,* many species.

The coast Indians of California use clover as a food. The fresh leaves and stems are used, before flowering. "Deserves test as a salad herb, with vinegar and salt."

COMFREY. *Symphytum officinale.* Waste places. Newf. to Minn., south to Md. Naturalized. *June-Aug.*

Makes good greens when gathered young.

COW PEA. China Bean. *Vigna Sinensis.* Escaped from cultivation. Mo. to Texas and Ga. *July-Sep.*

The seeds are edible.

COW PEPPER. A plant resembling toothwort (*Dentaria diphylla*) but bearing a yellow instead of a white flower, and developing a bur. Tops used in the southern Appalachians for salad, and the roots as a substitute for horseradish.

CRESS, ROCKET. Yellow Rocket. Bitter Cress. *Barbarea Barbarea* (*B. vulgaris*). Fields and waste places. Naturalized. Labrador to Va., and locally in interior; also on Pacific coast. *Apr.-June.*

The young, tender leaves make a fair salad, but inferior to the winter cress.

CRESS, WATER. *Roripa Nasturtium* (*Nasturtium officinale*). Brooks and other streams, Nova Scotia to Manitoba, south to Va. and Mo. Naturalized from Europe. *Apr.-Nov.*

A well-known salad herb. The leaves and stems are eaten raw with salt, as a relish, or mixed as a salad.

CRESS, WINTER. Scurvy Grass. *Barbarea praecox.* Waste places, naturalized. Southern N. Y., Pa., and southward. *Apr.-June.*

Highly esteemed as a winter salad and pot-herb; sometimes cultivated.

CRINKLE-ROOT. Two-leaved Toothwort. *Dentaria diphylla.* Rich woods and meadows. Nova Scotia to Minn., south to S. Car. and Ky. *May.*

The rootstocks are crisp and fleshy, with a spicy flavor like watercress. Eaten with salt, like celery.

CROWFOOT, CELERY-LEAVED OR DITCH. *Ranunculus sceleratus.* Swamps and wet ditches, New Brunsw. to Fla., abundant along the coast, and locally westward to Minn. *Apr.-Aug.*

Porcher cites this as a good example of the destruction of acrid and poisonous juices by heating. The fresh juice is so caustic that it will raise a blister, and two drops taken internally may excite fatal inflammation. Yet the boiled or baked root, he says, is edible. When cleansed, scraped and pounded, and the pulp soaked in a considerable quantity of water, a white sediment is deposited, which, when washed and dried, is a real starch.

CUCKOO-FLOWER. Meadow Bitter-cress. *Cardamine pratensis.* Wet meadows and swamps. Labrador to northern N. J., west to Minn. and B. C. *Apr.-May.*

Has a pungent savor and is used like water cress; occasionally cultivated as a salad plant.

DANDELION. *Taraxacum Taraxacum (T. Officinale).* Fields and waste places everywhere; naturalized. *Jan.-Dec.*

Common pot-herb; also blanched for salad. In boiling, change the water two or three times.

DOCK, CURLED. *Rumex Crispus.* Fields and waste places, everywhere; naturalized. *June-Aug.*

The young leaves make good pot-herbs. The plant produces an abundance of seeds, which Indians grind into flour for bread or mush.

FERNS. Many species.

The young stems of ferns, gathered before they

are covered with down, and before the leaves have uncurled, are tender, and when boiled like asparagus are delicious.

The rootstocks of ferns are starchy, and after being baked resemble the dough of wheat; their flavor is not very pleasant, but they are by no means to be despised by a hungry man.

FETTICUS. Corn Salad. *Valerianella Locusta.* Waste places. N. Y. to Va. and La. Naturalized. *Apr.-July.*

Cultivated for salad and as a pot-herb. The young leaves are very tender.

FLAG, CAT-TAIL. *Typha latifolia.* Marshes. Throughout North America except in extreme north. *June-July.*

The flowering ends are very tender in the spring, and are eaten raw, or when boiled in water make a good soup. The root is eaten as a salad. "The Cossacks of the Don peel off the outer cuticle of the stalk and eat raw the tender white part of the stem extending about 18 inches from the root. It has a somewhat insipid, but pleasant and cooling taste."

GARLIC, WILD OR MEADOW. *Allium Canadense.* Moist meadows and thickets. Me. to Minn., south to Fla., La., Ark. *May-June.*

A good substitute for garlic. "The top bulbs are superior to the common onion for pickling."

GINSENG, DWARF. Ground-nut. *Panax trifolium* (*Aralia trifolia*). Moist woods and thickets. Nova Scotia to Ga., west to Minn., Iowa, Ill. *Apr.-June.*

The tubers are edible and pungent.

HONEWORT. *Deringa Canadensis* (*Cryptotaenia C.*). Woods. New Brunsw. to Minn., south to Ga. and Texas. *June-July.*

In the spring this is a wholesome green, used in soups, etc., like chervil.

HOP. *Cannabis sativa.* Waste places. New Brunsw. to Minn., south to N. C., Tenn., Kansas. Naturalized. *July-Sep.*

Used for yeast. "In Belgium the young shoots

of the plant just as they emerge from the ground are used as asparagus."

Indian Cucumber. *Medeola Virginiana.* Rich, damp woods and thickets. Nova Scotia to Minn., south to Fla. and Tenn. *May-June.*

"The common name alludes to the succulent, horizontal, white tuberous root, which tastes like cucumber, and was in all probability relished by the Indians." (Matthews.)

Jerusalem Artichoke. Canada Potato. Girasole. Topinambour. *Helianthus tuberosus.* Moist soil. New Brunsw. to Manitoba, south to Ga. and Ark. "Often occurs along roadsides in the east, a relic of cultivation by the aborigines."

Now cultivated and for sale in our markets. The tubers are large, and edible either raw or cooked, tasting somewhat like celery root. They are eaten as vegetables, and are also pickled.

Lady's Thumb. English Smartweed. *Polygonum Persicaria.* Waste places throughout the continent, except extreme north. Naturalized; often an abundant weed. *June-Sep.*

Used as an early salad plant in the southern mountains.

Lamb's Quarters. White Pigweed. *Chenopodium album.* Waste places, range universal, like the above. Naturalized. *June-Sep.*

A fine summer green and pot-herb, tender and succulent. Should be boiled about 20 minutes, the first water being thrown away, owing to its bad taste. The small seeds, which are not unpleasant when eaten raw, may be dried, ground, and made into cakes or gruel. They resemble buckwheat in color and taste, and are equally nutritious.

Lettuce, Spanish. Indian or Miner's Lettuce. *Claytonia perfoliata.* Native of Pacific coast, but spreading eastward. *Apr.-May.*

The whole plant is eaten by western Indians and by whites. In a raw state makes an excellent salad; also cooked with salt and pepper, as greens.

Lupine, Wild. Wild Pea. *Lupinus perennis.*

Dry, sandy soil. Me. to Minn., south to Fla., Mo., La. *May-June.*

Edible; cooked like domestic peas.

Mallow, Marsh. *Althaeea Officinalis.* Salt marshes. Mass. to N. J. *Summer.*

The thick, very mucilaginous root, has familiar use as a confection; also used in medicine as a demulcent. May be eaten raw.

Mallow, Whorled or Curled. *Malva verticillata* (*M. crispa*). Waste places. Nova Scotia to Minn., south to N. J. Naturalized. *Summer.*

A good pot-herb.

Marigold, Marsh. Meadow-gowan. Cowslip. *Caltha palustris.* Swamps and meadows. Newfoundland to S. C., west through Canada to Rocky Mts., and south to Iowa. *Apr.-June.*

Used as a spring vegetable, the young plant being thoroughly boiled for greens. The flower buds are sometimes pickled as a substitute for capers.

Beware of mistaking for this plant the poisonous white hellebore (*Veratrum viride*).

Meadow Beauty. Deer Grass. *Rhexia Virginica.* Sandy swamps. Me. to Fla., west to north N. Y., Ill., Mo., La. *July-Sep.*

The leaves have a sweetish, yet acidulous taste. Make a good addition to a salad, and may be eaten with impunity.

Milkweed. *Asclepias Syriaca* (*A. Cornuti*). Fields and waste places generally. *June-Aug.* Also other species.

The young shoots, in spring, are a good substitute for asparagus. Kalm says that a good brown sugar has been made by gathering the flowers while the dew was on them, expressing the dew, and boiling it down.

Mushrooms. The number of edible species is legion. It is not difficult to distinguish the poisonous ones, when one has studied a good text-book; but no one should take chances with fungi until he has made such study, for a few of the common species are deadly, and for some of them no remedy

is known. A beginner would do well, perhaps, to avoid all of the genus *Amanita*. All mushrooms on the following list are of delicious flavor.

Coprinus comatus
Hypholoma appendiculatum
Tricholoma personatum
Boletus subaureus.
Boletus bovinus
Boletus subsanguineous
Clavaria botrytes
Clavaria cinerea
Clavaria inaequalis
Clavaria vermicularis
Clavaria pistillaris
Lactarius volemus
Lactarius deliciosus
Russula alutacea
Russula virescens
Cantharelles cibarius
Marasmius oreades
Hydnum repandum
Hydnum caput-Medusae
Morchella esculenta
Morchella deliciosa

It would be well for every outer to learn the easily distinguishable beefsteak fungus (*Fistulina hepatica*) and sulphur mushroom (*Polyporus sulphureus*) that grow from the trunks of old trees and stumps, as they are very common, very large, and "filling."

MUSTARD. *Brassica,* several species. Fields and waste places. Naturalized.

The young leaves are used for greens.

NETTLE. *Urtica dioica,* and other species; also the Sow Thistle, *Sonchus oleraceus.* Fields and waste places.

Should be gathered, with gloves, when the leaves are quite young and tender. A pleasant, nourishing and mildly aperient pot-herb, used with soups,

salt meat, or as spinach; adds a piquant taste to other greens. Largely used for such purposes in Europe.

NIGHTSHADE, BLACK OR GARDEN. *Solanum nigrum.* Waste places, commonly in cultivated soil. Nova Scotia to Manitoba, south to Fla. and Texas. *July-Oct.*

This plant is reputed to be poisonous, though not to the same degree as its relative from Europe, the Woody Nightshade or Bittersweet (*S. Dulcamara*). It is, however, used as a pot-herb, like spinach, in some countries, and in China the young shoots and berries are eaten. Bessey reports that in the Mississippi Valley the little black berries are made into pies.

ONION, WILD. *Allium,* many species. Rich woods, moist meadows and thickets, banks and hillsides.

Used like domestic onions.

PARSNIP, COW. Masterwort. *Heracleum lanatum.* Moist ground. Labrador to N. C. and Mo., Alaska to Cal. *June-July.*

"The tender leaf and flower stalks are sweet and very agreeably aromatic, and are therefore much sought after [by coast Indians] for green food in spring and early summer, before the flowers have expanded. In eating these, the outer skin is rejected."

PEPPERGRASS, WILD. *Lepidium Virginicum.* Fields and along roadsides. Quebec to Minn., south to Fla. and Mexico. *May-Nov.*

Like the cultivated peppergrass, this is sometimes used as a winter or early salad, but it is much inferior to other cresses. The spicy pods are good seasoning for salads, soups, etc.

PIGWEED, ROUGH. Beet-root. *Amaranthus retroflexus.* Fields and waste places. Throughout the continent except extreme north. Naturalized. *Aug.-Oct.*

Related to the beet and spinach, and may be used for greens.

PIGWEED, SLENDER. Keerless. *Amaranthus hybridus* (*A. chlorostachys*). A weed of the same wide range as the preceding. Naturalized. *Aug.-Oct.*

Extensively used in the South, in early spring, as a salad plant, under the name of "keerless."

PLANTAIN, COMMON. *Plantago major.* A naturalized weed of general range like the preceding. *May-Sep.*

Used as early spring greens.

PLEURISY-ROOT. *Asclepias Tuberosa.* Dry fields. Me. to Minn., south to Fla., Texas, Ariz. *June-Sep.*

The tender young shoots may be used like asparagus. The raw tuber is medicinal; but when boiled or baked it is edible.

POKEWEED. *Phytolacca decandra.* A common weed east of the Mississippi and west of Texas. Now cultivated in France, and the wild shoots are sold in our eastern markets.

In early spring the young shoots and leaves make an excellent substitute for asparagus.

The root is poisonous (this is destroyed by heat), and the raw juice of the old plant is an acrid purgative. The berries are harmless.

PRICKLY PEAR. *Opuntia.* Several species. Dry, sandy soil. Along eastern coast, and on western prairies and plains.

The ripe fruit is eaten raw. The unripe fruit, if boiled ten or twelve hours, becomes soft and resembles apple-sauce. When the leaves are roasted in hot ashes, the outer skin, with its thorns, is easily removed, leaving a slimy but sweet and succulent pulp which sustains life. Should be gathered with tongs which can be extemporized by bending a green stick in the middle and beathing it over the fire.

PRIMROSE, EVENING. *Onagra biennis* (*Oenothera b.*). Usually in dry soil. Labrador to Fla., west to Rocky Mts. *June-Oct.*

Young sprigs are mucilaginous and can be eaten as salad. Roots have a nutty flavor, and are used in Europe either raw or stewed, like celery.

PURSLANE. Pussley. *Portulaca Oleracea.* Fields and waste places. A weed of almost world-wide distribution. *Summer.*

This weed was used as a pot-herb by the Greeks and Romans, and is still so used in Europe. The young shoots should be gathered when from 2 to 5 inches long. May also be used as a salad, or pickled. Taste somewhat like string beans, with a slight acid flavor. The seeds, ground to flour, have been used by Indians in the form of mush.

RED-BUD. *Cercis Canadensis.*

French-Canadians use the acid flowers of this tree in salads. The buds and tender pods are pickled in vinegar. All may be fried in butter, or made into fritters.

SAXIFRAGE, LETTUCE. *Saxifraga micranthidifolia.* In cold brooks. Appalachian Mts. from Pa. to N. C. *May-June.*

Eaten by Carolina mountaineers as a salad under the name of "lettuce."

SHEPHERD'S PURSE. *Bursa Bursa-pastoris* (*Capsella B.*). Fields and waste places everywhere. Naturalized. *Jan.-Dec.*

A good substitute for spinach. Delicious when blanched and served as a salad. Tastes somewhat like cabbage, but is much more delicate.

SKUNK CABBAGE. *Spathyema foetida* (*Symplocarpus f.*). Swamps and wet soil. Throughout the east, and west to Minn. and Iowa. *Feb.- April.*

The root of this foul-smelling plant was baked or roasted by eastern Indians, to extract the juice, and used as a bread-root. Doubtless they got the hint from the bear, who is very fond of this, one of the first green things to appear in spring.

SOLOMON'S SEAL. *Polygonatum biflorum.* Woods and thickets. New Brunsw. to Mich., south to Fla. and W. Va. *April-July.*

Indians boiled the young shoots in spring and ate them; also dried the mature roots in fall, ground or pounded them, and baked them into bread. The raw plant is medicinal.

SORREL, MOUNTAIN. *Oxyria digyna.* Greenland to Alaska, south to White Mts. of N. H. and in Rocky Mts. to Colo. *July-Sep.*

A pleasant addition to salads.

SORREL, SHEEP. *Rumux Acetosella.* Dry fields and hillsides. Throughout the continent, except in extreme north. *May-Sep.*

The leaves are very acid. Young shoots may be eaten as a salad. Also used as a seasoning for soups, etc.

The European sorrels cultivated as salad plants are *R. Acetosa, R. scutatus,* and sometimes *R. Patientia.*

SORRELL, WHITE WOOD. *Oxalis Acetosella.* Cold, damp woods. Nova Scotia to Manitoba, mts. of N. C., and north shore of Lake Superior. *May-July.*

Not related to the above. "The pleasant acid taste of the leaves, when mixed with salads, imparts an agreeable, refreshing flavor." The fresh plant, or a "lemonade" made from it, is very useful in scurvy, and makes a cooling drink for fevers. Should be used in moderation, as it contains binoxalate of potash, which is poisonous. Yields the druggist's "salt of lemons."

STORKSBILL. Pin-clover. *Erodium cicutarium.* Waste places and fields. Locally in the east, abundant in the west. *April-Sep.* Naturalized.

The young plant is gathered by western Indians and eaten raw or cooked.

STRAWBERRY BLITE. *Blitum capitatum* (*Chenopodium c.*). Dry soil. Nova Scotia to Alaska, south to N. J., Ill., Colo., Utah, Nev. *June-Aug.*

Sometimes cultivated for greens. Used like spinach.

TRILLIUM. Wake-robin. Beth-root. *Trillium erectum;* also *T. undulatum* and *T. grandiflorum.* Woods. Nova Scotia to Minn., and south to Fla. *April-June.*

The popular notion that these plants are poisonous is incorrect. They make good greens when

cooked. The root has medicinal qualities.

TUCKAHOE. *Pachyma cocos.* A subterranean fungus which grows on decaying vegetable matter, such as old roots. It is found in light, loamy soils and in dry waste places, but not in very old fields or in woodlands. Outwardly it is woody, resembling a cocoanut or the bark of a hickory tree. The inside is a compact, white, fleshy mass, moist and yielding when fresh, but in drying it becomes very hard, cracking from within. It contains no starch, but is composed largely of pectose. The Indians made bread of it, and it is sometimes called Indian Bread. (For details, see an article by Prof. J. H. Gore in *Smithsonian Report,* 1881, pp. 687-701.)

UNICORN PLANT. *Martynia Lousiana* (*M. proboscidea*). Waste places. Me. to N. J. and N. C. Native in Mississippi Valley from Iowa and Ill. southward. *July-Sep.*

Cultivated in some places. The seed-pods, while yet tender, make excellent pickles. The Apaches gather the half-ripe pods of a related species and use them for food.

VETCH, MILK. *Astragalus,* several species. Prairies. *May-Aug.*

Used as food by the Indians. The pea is hulled and boiled.

VIOLET, EARLY BLUE. *Viola palmata.* Dry soil, mostly in woods. Me. to Minn., south to Ga. and Ark. *April-May.*

"The plant is very mucilaginous, and is employed by negroes for thickenig soup, under the name of 'wild okra.'" (Porcher.)

WATERLEAF. *Hydrophyllum Virginicum.* Woods. Quebec to Alaska, south to S. C., Kan., Wash. *May-Aug.*

"Furnishes good greens. Reappears after being picked off, and does not become woody for a long time."

WILD FRUITS

It would extend this chapter beyond reasonable limits if I were to give details of all the wild fruits

native to the region here considered. As fruits may be eaten raw, or require no special treatment in cooking, a mere list of them, with the time of ripening, must suffice:

Carolina Buckthorn. *Rhamnus Caroliniana. Sep.*

Woolly-leaved Buckthorn. *Bumelia languinosa. June-July.*

Buffalo-berry. *Lepargyraea argentea. July-Aug.*

American Barberry. *Berberis Canadensis. Aug.-Sep.*

Common Barberry. *Berberis vulgaris. Sep.* Naturalized.

Bailey's Blackberry. *Rubus Baileyanus.*

Bristly Blackberry. *R. setosus.*

Dewberry. *R. Canadensis. June-July.*

High Bush Blackberry. *R. villosus. July-Aug.*

Hispid Blackberry. *R. hispidus. Aug.*

Low Bush Blackberry. *R. trivialis.*

Millspaugh's Blackberry. *R. Millspaughii. Aug.-Sep.*

Mountain Blackberry. *R. Alleghaniensis. Aug.-Sep.*

Sand Blackberry. *R. Cuneifolius. July-Aug.*

Dwarf Bilberry. *Vaccinium caespitosum. Aug.*

Great Bilberry. *V. uliginosum. July-Aug.*

Oval-leaved Bilberry. *V. ovalifolium. July-Aug.*

Thin-leaved Bilberry. *V. membranaceum. July-Aug.*

Black Blueberry. *V. atrococcum. July-Aug.*

Canada Blueberry. *V. Canadense. July-Aug.*

Dwarf Blueberry. *V. Pennyslvanicum. June-July.*

High Bush Blueberry. *V. corymbosum. July-Aug.*

Low Blueberry. *V. vacillans. July-Aug.*

Low Black Blueberry. *V. nigrum. July.*

Mountain Blueberry. *V. pallidum. July-Aug.*

Southern Black Huckleberry. *V. virgatum. July.*

Mountain Cranberry. Windberry. *V. Vitis-Idaea. Aug.-Sep.*

Black Huckleberry. *Gaylussacia resinosa. July-Aug.*

Box Huckleberry. *G. brachycera.*
Dwarf Huckleberry. *G. dumosa. July-Aug.*
Tangleberry. *G. frondosa. July-Aug.*
Appalachian Cherry. *Prunus cuneata.*
Choke Cherry. *P. Virginiana. July-Aug.* (Edible later.)
Sand Cherry. *P. pumila. Aug.*
Sour Cherry. Egriot. *P. Cerasus. June-July.* Naturalized.
Western Wild Cherry. *P. demissa. Aug.*
Western Sand Cherry. *P. Besseyi.*
Wild Cherry. Crab Cherry. *P. Avium.* Naturalized.
Wild Black Cherry. *P. serotina. Aug.-Sep.*
Wild Red Cherry. *P. Pennsylvanica. Aug.*
American Crab-Apple. Sweet-scented C. *Malus coronaria. Sep.-Oct.*
Narrow-leaved Crab-Apple. *M. angustifolia.*
Soulard Crab-Apple. *M. Soulardi.*
Western Crab-Apple. *M. Ioensis.*
American Cranberry. *Oxycoccus macrocarpus. Sep.-Oct.*
Small Cranberry. Bog C. *O. Oxycoccus. Aug.-Sep.*
Southern Mountain Cranberry. *O. erythrocarpus July-Sep.*
Cranberry Tree. *Viburnum Opulus. Aug.-Sep.*
Crowberry. Curlew-berry. *Empetrum nigrum. Summer.*
Golden Current. Buffalo or Missouri C. *Ribes aureum.*
Northern Black Currant. *R. Hudsonianum.*
Red Currant. *R. rubrum.*
Wild Black Currant. *R. floridum. July-Aug.*
Elderberry. *Sambucus Canadensis. Aug.*
Wild Gooseberry. Dogberry. *Ribes Cynosbati. Aug.*
Missouri Gooseberry. *R. gracile.*
Northern Gooseberry. *R. oxyacanthoides. July-Aug.*
Round-leaved Gooseberry. *R. rotundifolium. July-Aug.*

Swamp Gooseberry. *R. lacustre. July-Aug.*

Bailey's Grape. *Vitis Baileyana.*

Blue Grape. Winter G. *V. bicolor.*

Downy Grape. *V. cinerea.*

Frost Grape. *V. cordifolia. Oct.-Nov.*

Missouri Grape. *V. palmata. Oct.*

Northern Fox Grape. *V. Labrusca. Aug.-Sep.*

Riverside Grape. Sweet-scented G. *V. vulpina. July-Oct.*

Sand Grape. Sugar G. *V. rupestris. Aug.*

Southern Fox Grape. *V. rotundifolia. Aug.-Sep.*

Summer Grape. *V. aestivalis. Sep.-Oct:*

Ground Cherry. *Physalis,* several species.

Hackberry. *Celtis occidentalis. Sep.-Oct.* Berries dry but edible.

Black Haw. *Viburnum prunifolium. Sep.-Oct.*

Scarlet Haw. Red H. *Crataegus mollis. Sep.-Oct.*

May Apple. Mandrake. *Podophyllum peltatum. July.*

Passion-flower. *Passiflora incarnata;* also *P. lutea.* Fruit known as Maypops.

Pawpaw. *Asimina triloba.* Fruit edible when frost-bitten.

Persimmon. *Diospyros Virginiana.* Fruit edible after frost.

Beach Plum. *Prunus martima. Sep.-Oct.*

Canada Plum. *P. nigra. Aug.*

Chickasaw Plum. *P. angustifolia. May-July.*

Low Plum. *P. gracilis.*

Porter's Plum. *P. Alleghaniensis. Aug.*

Watson's Plum. *P. Watsoni.*

Wild Goose Plum. *P. hortulana. Sep.-Oct.*

Wild Red Plum. Yellow P. *P. Americana. Aug.-Oct.*

Ground Plum. *Astragalus crassicarpus;* also *A. Mexicanus.* Unripe fruit resembles green plums, and is eaten raw or cooked.

Black Raspberry. Thimble-berry. *Rubus occidentalis. July.*

Cloudberry. *R. Chamaemorus.*

Dwarf Raspberry. *R. Americanus. July-Aug.*
Purple Wild Raspberry. *R. neglectus. July-Aug.*
Purple-flowering Raspberry. *R. odoratus. July-Sep.*
Salmon-berry. *R. parviflorus. July-Sep.*
Wild Red Raspberry. *R. strigosus. July-Sep.*
Service-berry. June-berry. *Amelanchier Canadensis. June-July.*
Low June-berry. *A. spicata.*
Northwestern June-berry. *A. alnifolia.*
Round-leaved June-berry. *A. rotundifolia. Aug.*
Shad-bush. *A. Botryapium. June-July.*
Silver Berry. *Elaeagnus argentea. July-Aug.*
Creeping Snowberry. *Chiogenes hispidula. Aug.-Sep.* Berries have flavor or sweet birch.
American Wood Strawberry. *Fragaria Americana.*
Northern Wild Strawberry. *F. Canadensis.*
Virginia Strawberry. Scarlet S. *F. Virginiana.*
Black Thorn. Pear Haw. *Crataegus tomentosa. Oct.*
Large-fruited Thorn. *C. punctata. Sep.-Oct.*
Scarlet Thorn. *C. coccinea. Sep.-Oct.*

MAPLE SUGAR AND SIRUP

Anyone who has access to maple trees in the spring of the year can make the best of sirup and sugar, without any special appliances, provided he takes some pains to keep the sap clean and unsoured.

The sap season generally begins about the middle of March and lasts until the third week in April, but varies with a late or an early spring. Sap may begin to flow in mid February, or may be held back until the first of April. It continues "good" from three to six weeks; that is, until the buds swell, after which the sap becomes strong and "buddy." It flows best on a warm day succeeding a freezing night. Trees with large crowns yield the most sap. Those standing in or near cold springs discharge the most and sweetest sap. An average tree may yield, in favorable weather, about two gallons of sap in 24 hours.

The Indians' and early frontiersmen's method of

tapping a tree was to "box" it by cutting a slanting notch in the trunk, about 8 inches long, two or three feet from the ground, and inserting an elder or sumac spout in the bark below the lower end of the notch, from which the sap was caught in a trough or pail; or, two gashes would be cut like a broad V, and a spout was put in at the bottom. Such notching yields a rapid flow, but spoils the tree.

A better way is to bore a hole through the outer bark and just into the sapwood (say from one to two inches depth) on the sunny side of the tree, and insert a spout. With wooden spouts the hole must be larger than when iron ones are used, but make it no larger than necessary (certainly not over one inch), or you will injure the tree. The hole should slope slightly upward.

Place a bucket under each spout. It may be necessary, in a wild region, to drive stout stakes around the buckets in such way that they cannot be robbed; for wild animals, as well as domestic ones, are inordinately fond of maple sap, which seems to exhilarate them when taken in large quantities.

Collect the sap every morning, before it can get warm from the heat of the sun, as it sours easily. Boil it in a kettle to the consistency of honey; then dip it out, pass through woolen strainers, and allow it to stand several hours until impurities have precipitated. It is then ready for use.

To make maple sugar, boil the sirup in a kettle deep enough to keep it from boiling over. Keep it simmering over a slow fire until a heavy scum rises to the surface. Skim this off, and continue the boiling until, when a little of the sirup is stirred in a saucer, it grains (granulates); or until, when spread on the snow, it candies on cooling. Then pour it off into molds. As a rule, it takes about four gallons of sap to make a pound of sugar, and 35 gallons to make a gallon of sirup, but there are wide variations, according to quality of sap.

Sap may be reduced to sugar by alternate freezing and thawing, the ice being thrown away each time it freezes.

Just as good sugar and sirup are made from the red maple and from the silver (white or soft) maple as from the sugar maple (rock maple or sugar tree). but the sap is not quite so rich in sugar, and the running season is shorter. Since these trees bud earlier than sugar maple, they should be tapped earlier. The sap of the ash-leaved maple (com-

monly called box elder) has similar qualities; also that of the striped maple (moosewood, striped or swamp dogwood), but this tree seldom grows large enough to be worth using.

There is a decided maple flavor in the sap of the shellbark hickory. A good sirup can be concocted by steeping a handful of the dried and crushed inner bark of this tree in hot water to a strong "tea" and adding sufficient brown sugar. An extract commercially made from the bark is used in making a spurious "maple sirup" out of cane or corn sirup. It is safe to say that not one-tenth of the alleged maple sugar and sirup now on the market is free from this or similar adulteration.

As a backwoods expedient, sirup may be made from the abundant and sugary sap of the black birch (sweet birch). In times of scarcity the pods of the honey locust have been utilized to the same end. They must be used within a month after maturity; later they become bitter.

BEVERAGES

None of our native plants contain principles that act upon the nerves like the caffein of coffee or the thein of tea; consequently all substitutes for coffee and tea are unsatisfying, except merely as hot drinks of agreeable taste. Millions of war-bound people are suffering this deprivation now.

In the South, during the Civil War, many pitiful expedients were tried, such as decoctions of parched meal, dried sweet potatoes, wheat, chicory, cotton-seed, persimmon-seed, dandelion-seed, and the seeds of the Kentucky coffee-tree. Better substitutes for coffee were made from parched rye, from the seeds of the coffee senna (*Cassia occidentalis*) called "Magdad coffee," and from the parched and ground seeds of okra. Governor Brown of Georgia once said that the Confederates got more satisfaction out of the goldenrod flowers than out of any other makeshift for coffee. "Take the bloom," he directed, "dry it, and boil to an extract" (meaning tincture).

Teas, so-called, of very good flavor can be made from the dried root-bark of sassafras, or from its early buds, from the bark and leaves of spicewood,

from the leaves of chicory, ginseng, dittany, the sweet goldenrod (*Solidago odora*), and cinquefoil. Other plants used for the purpose are Labrador tea, Oswego tea, and (inferior) New Jersey tea. Our pioneers also made decoctions of chips of the arbor-vitae (white cedar) and of sycamore, the dried leaves of black birch, and the tips of hemlock boughs, sweetening them with maple sugar; but here we approach the list of medicinal teas, which is well-nigh endless. The Indians made a really good "maple tea" by boiling sassafras-root bark for a short time in maple sap.

Agreeable summer drinks can be made by infusing the sour fruit of the mountain ash (*Pyrus Americana*), from sumac berries (dwarf and staghorn), and from the fruit of the red mulberry. The sweet sap of both hard and soft maples, box elder, and the birches (except red birch) is potable. Small beer can be made from the sap of black birch, from the pulp of honey locust pods, the fruit of the persimmon, shoots and root-bark of sassafras, and the twigs of black and red spruce. Cider has been made from the fruit of crab-apples and service-berries.

CONDIMENTS

Vinegar can be made from maple or birch sap, or from fruit juices, by diluting with water and adding a little yeast. The very sour berries of sumac turn cider into vinegar, or they may be used alone.

Our fields and forests afford many pleasant condiments for flavoring. Sassafras, oil of birch, wintergreen, peppermint and spearmint will occur to every one. Balm, sweet marjoram, summer savory and tansy are sometimes found in wild places, where they have escaped from cultivation. The rootstock of sweet cicely has a spicy taste, with a strong odor of anise, and is edible. Sweet gale gives a pleasant flavor to soups and dressings. The seeds of tansy mustard were used by the Indians in flavoring dishes. Wild garlic ("ramps"), wild onions, peppergrass, snowberry and spicewood may be used for similar purposes.

Perhaps the greatest privation that a civilized man suffers, next to having no meat, is to lack salt and

tobacco. In the old days they used to burn the outside of meat and sprinkle gunpowder on it in lieu of salt; but in this age of smokeless powder we are denied even that consolation. The ashes of plants rich in nitre, such as tobacco, Indian corn, sunflower, and the ashes of hickory bark, have been recommended. Coville says that the ash of the palmate-leaf sweet coltsfoot (*Petasites palmata*) was highly esteemed by western Indians as a substitute for salt. "To obtain the ash the stem and leaves were first rolled up into balls while still green, and after being carefully dried they were placed on top of a very small fire on a rock, and burned." Perhaps a better plan is to make lye by pouring boiling water on wood ashes, strain, and evaporate to a white crystalline alkali. Use sparingly.

Many Indians, even civilized ones like some of the eastern Cherokees, do not use salt to this day. Strange to say, the best substitute for salt is sugar, especially maple sugar or sirup. One soon can accustom himself to eat it even on meat. Among some of the northern tribes, maple sirup not only takes the place of salt in cooking, but is used for seasoning the food after it is served. Wild honey, boiled, and the wax skimmed off, has frequently served me in place of sugar in my tea, in army bread, etc.

KINNIKINICK

Men who use tobacco can go a good while hungry without much grumbling, so long as the weed holds out.

> Thou who, when cares attack,
> Bidd'st them avaunt! and Black
> Care, at the horseman's back
>   Perching, unseatest!

But let tobacco play out, and they are in a bad way! Substitutes for it may be divided into those that are a bit better than nothing and those that are worse. Among the latter may be rated tea. Yes, tea is smoked by many a poor fellow in the far North! It is said to cause a most painful irritation in the throat, which is aggravated by the cold air of that region. Certainly it can have no such effect on the nerves as tobacco, for it is full of tannin, and tannin destroys nicotin.

Kinnikinick is usually made of poor tobacco mixed with the scrapings or shavings of other plants, although the latter are sometimes smoked alone. Chief

of the substitutes is the red osier dogwood (*Cornus stolonifera*) or the related silky cornel (*C. sericea*) commonly miscalled red willow. These shrubs are very abundant in some parts of the North. The dried inner bark is aromatic and very pungent, highly narcotic, and produces in those unused to it a heaviness sometimes approaching stupefaction. Young shoots are chosen, or such of the older branches as still keep the thin, red outer skin. This skin is shaved off with a keen knife, and thrown away. Then the soft, brittle, green inner bark is scraped off with the back of the knife and put aside for use; or, if wanted immediately, it is left hanging to the stem in little frills and is crisped before the fire. It is then rubbed between the hands into a form resembling leaf tobacco, or is cut very fine with a knife and mixed with tobacco in the proportion of two of bark to one of the latter.

A more highly prized kinnikinick is made from the leaves of the bear-berry or uva-ursi (*Arctostaphylos-uva-ursi*), called *sacaoommis* by the Canadian traders, who sell it to the northern Indians for more than the price of the best tobacco. The leaves are gathered in the summer months, being then milder than in winter. Inferior substitutes are the crumbled dried leaves of the smooth sumac (*Rhus glabra*) and the fragrant sumac (*R. aromatica*), which, like tea, contain so much tannin that they generally produce bronchial irritation or sore throat.

CHAPTER XXII

LIVING OFF THE COUNTRY—*IN EXTREMIS*

As I said at the beginning, the supreme test of woodcraft comes when the equipment has been destroyed by some disaster. Such misfortunes are not uncommon; if we seldom hear of them it is because they happen in far-away, isolated places, and the survivors are not interviewed by the press. A man gets lost and has to wander for a week, two weeks, or longer, before he meets a human being. A canoe is smashed to bits in a rapid, a hundred miles from the nearest outpost, and the men get ashore with nothing but the clothes they stand in and the contents of their pockets. And worse has happened. Robinson Crusoe had a prentice job compared to the actual experiences of hundreds of men and women whom fate has thrown, destitute of tools or weapons, far from the paths and courses of civilization.

The pity is that such disasters befall, in so many cases, people who have no knowledge of how to meet them. Helplessness breeds despair. One woodsman, at such a time, will rustle more food than a company of tenderfoots. At the worst he will find something to keep him going—something that the others, though starving, would pass by without knowing that it could give them energy.

In this sort of emergency, needless to say, there is but one law: self-preservation. Game laws and other rules of sportsmanship are, for the time, nonexistent. The sufferer will kill anything that can be eaten, in any way that he can get it. If all

game has migrated, and fish cannot be caught, he will eat anything that will give him strength, no matter how unpleasant it would be at other times.

A man without a gun will depend, for animal food, chiefly upon fish and upon such game as he can capture with snares. When one ventures into the wilderness he knows well enough that he may meet disaster at the most unexpected moment, and there is no excuse for him ever being caught without a jackknife, a waterproof box filled with matches, a compass, a good length of stout fish-line, and some hooks. (A woodsman sleeps in his trousers, and he will not even risk bathing where there is danger of losing them.) If he must spend all the daylight in traveling, he can at least set out a night-line for fish and snares for rabbits or other small mammals.

Snaring.—It is not worth while here to describe deadfalls, pitfalls, coop traps, and the like; for our adventurer probably has no tool to make them, nor anything to bait them with. Anyway, a snare will serve just as well, takes much less time and material to set up, and game can be caught in it without any bait at all.

Ground snares, which catch by the feet or legs, are not to be considered, as they are likely to be broken by the animal's frantic plunges, or may be chewed off, unless made of wire. The surest way is to fix a noose to a spring-pole, and set it with a trigger, so as to catch the animal round the neck and jerk it up into the air where its struggles are soon over.

Just how to set a snare depends upon what kind of animal you try for. Take, for example, rabbits (I use this word generically to include cottontails and hares of all degrees). They are the commonest of game everywhere, from far north to farthest south, in swamps, in woodlands, on the plains, and up the mountains to tree limit. Since they are fond of beaten paths, and are not of a suspicious nature, they can be caught without bait;

although their food is such that even a lost man can find it if he chooses to bait his snares. They do not hibernate, but are out all the year round. So the rabbit is a lost man's main chance in the meat line.

A good snare for setting in a runway is shown in Fig. 190. It catches "coming or going." A small, springy sapling (*A*), growing a few feet to

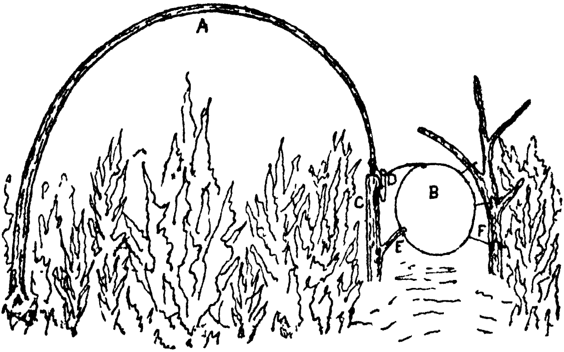


Fig. 190.—Runway snare

one side of the rabbit path, is trimmed, and will be bent over for setting. If none grows in the right place, cut one and drive it firmly into a hole made with a sharpened stick, or lash it to a tree or stub. The best place for a snare is in the bend of a runway with plenty of bushes on both sides. Drive a stout stake at *C,* and notch it for the trigger *D.* Plant opposite it, at *F,* a dead branch that forks over top of snare so the animal will run under, but not in such a way as to entangle the loop when sprung. Now take a length of soft brass or copper wire, or a strong cord (No. 1-0 braided linen fish-line is good), twist or tie it to the end of spring-pole and around the little wooden trigger, and form the long part into a noose. Bend the pole and set the trigger, as shown, extending loop over the runway, a couple of inches off the ground. The noose may be about six inches in diameter. If

of wire, it can be held in place by drawing it lightly into the cleft end of a stub, as at *E*, or a split stick stuck in the ground for that purpose. If cord is used, hold it in place with little twigs or with blades of grass bent round it and drawn back into nicks made with a knife in the stakes at each side, as at *F*. No bait is needed.

This is also a good snare to set at the mouth of a den or burrow.

As for baited snares, there are many ingenious ways of rigging them. One example will suffice. The bait itself will depend, of course, upon the kind of animal to be caught. For rabbits it may be succulent roots or wild fruits. The 'coon, 'possum, and skunk have a varied diet: grasshoppers, crickets, beetles, grubs, mussels, fish, crayfish, frogs, snakes, lizards, birds, eggs, nuts, fruits, roots; and lots of other things. The wildcat and the lynx are lured by any kind of meat, particularly if it is bloody. If the bait is so small or so delicate that it cannot be tied to the bait-stick, make for it a little pan of bark fastened to the stick. All wild animals are passionately fond of salt, and, if you have any of it, a pinch of salt rubbed on the bait will make it all the more enticing.

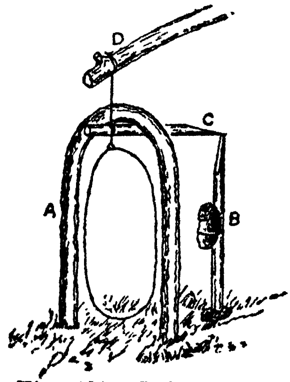


Fig. 191.—Baited snare

The snare shown in Fig. 191 is easy to rig, requires only a short length of wire or cord, and goes off like a hair trigger. Its dimensions will depend on the size of the animal it is set for. The idea is to have the loop only large enough for the prey to stick its head through without touching on more than one side, if any, and just high enough from the

ground so as not to catch by a leg or foot. The bait sets back only far enough for the noose to catch around the throat and behind the ears—except in case of a 'coon, which always reaches in with its paw, so the bait-stick must be set far enough back to allow for this.

For rabbits, cut a limber stick about two feet long and as thick as your thumb; sharpen both ends, bend in the middle, and drive in the ground in the form of an arch (*A*). The end of the spring-pole, when bent over, comes just over the top of this arch (*D*). Now cut a stick (*B*) of length corresponding to height of arch, trim one end to a slightly wedge-shaped point, and tie the bait to the middle. A similar stick (*C*) is cut of such length that, when rigged as here shown, the bait will stand at the right distance back of the arch. The figure shows how the noose is attached. If the ground is soft, set the butt of the bait-stick on a flat stone or chip.

To make the animal stick his head in through the arch, instead of elsewhere, drive dead sticks in a semi-circle, with the arch for an entrance, leaving twigs on them to give a natural appearance to the little den.

Such a snare can be used with success on large animals, a stronger spring-pole and noose being required, of course, and the pen made larger, accordingly. Even such powerful beasts as the bear and the moose can be caught with snares of twisted rawhide or rope—but we are considering only small game.

When setting for animals that are wily and suspicious, use no green sticks, but sound dead ones, rub dirt over the cuts, drop no chips about the snare, leave the ground undisturbed, and handle things as little as possible, for your own scent is a "give-away."

It is of no use to set snares or other traps except where there is recent "sign," such as tracks, droppings, twigs and bark nibbled, feathers or hair of

animals eaten, and so on. You must find where your quarry lives, or where it often goes in search of food.

If there is likelihood of a finely-set snare being sprung by birds or mice, make the ends of the trigger-sticks flat, with good bearing, and tie the bait on so firmly that it will take a smart tug to release the trigger.

A very simple and effective snare for birds, as well as for small mammals, is rigged by dropping a small evergreen or other bushy tree across a trail or runway, so that its stem is a foot or so above the ground (depending upon size of animal); then trim off enough under branches to leave an opening in the middle of the trail, and set a noose in it, attached to the tree. Two or three such openings may be made, with a noose in each. Scatter bait along the path on both sides of the tree. An animal finding a noose drawing about its neck will push onward, instead of backing out, and so choke itself to death.

If you have neither wire nor cord to make nooses with, use any of the strong, pliable rootlets, or bark cords, mentioned in Chapter XV. After one animal is captured, its skin and intestines can be made into strings or thongs for such purposes.

Fishing for the Pot.—Trout, perch, pickerel, and various other fishes, may be taken with hook and line any month in the year—when they are in the humor. In cold weather, fish the deep still water, through holes in the ice, if there are any.

Where suckers lie motionless, in plain view, they can be snared with a wire noose by dropping it gently in front and under one of them, and giving a jerk. Other fish sometimes may be taken in the same way. In hot weather, if you have no tackle at all, seek a small spring-hole, close its outlet with sticks and brush, build an artificial outlet, with rocks, etc., leading to a flat; then get into the spring-hole, thrash around with a stick, poke under

the ledges, and scare the fish out to where they will be stranded, so you may catch them with your naked hands. Some spring-holes can be made into traps themselves by digging a deeper outlet and running the water off.

Bait.—The commonest of all baits, earthworms, are *not* common in a wilderness. Generally they are creatures of the barnyard and garden. Out in the big woods they are too scarce to consider, except as accidental findings. If you chance upon an old lumber camp or saw-mill site, you may find worms in abundance by digging under piles of chips and sawdust. Sometimes, in a damp place in the forest, you can get active little red fellows (fine bait) under overturned rocks or logs, or under the moss on the banks of brooks. The largest worms I ever saw are found, after a warm shower, or just before nightfall, on the grassy summits of "balds" in the Great Smoky Mountains, nearly 6,000 feet above sea-level; some of them are full two feet long.

The best all-round bait is a lively minnow. You may catch minnows on a very small hook with most of the barb filed off, or even on a bent pin, baited with a tiny bit of meat, a maggot, a grub, or a small insect. In winter, try a spring-hole, or cut through the ice close to shore.

Three men working together can capture plenty of minnows in a few minutes, wherever there is a small stream, by using what we called in the Ozarks a "brush seine." Simply get a lot of willows or other pliable brush, lay the stuff overlapping to length desired, and twist a little until the branchlets interlock (like a farmer twisting a hay rope). Then, with a man at each end to haul, and another at the middle to hold the "seine" down in the water, drag the shallows and run the minnows ashore.

On dark days, or in rough or turbid water, the best baits are shiners, silversides (redfins), and other bright colored minnows; but they do not live

long on the hook. In sunny weather, and for clear, still water, chubs and other tough species are preferred, being more active and enduring. Almost any small fish will do in a pinch. Young yellow perch make excellent bait if the dorsal spine is clipped off. On the Potomac and the Susquehanna rivers a favorite bass bait is what they call a mad-tom, which is nothing but a small yellow catfish (stone cat) with its spines cut off. To keep a tom from running under a rock and anchoring himself there, they peel a bit of skin off the back of his head: one bump on that tender spot cures him!

For bass, pickerel, and mascalonge (spell it to suit yourself—here in the Carolina mountains the natives call it the "jack fish"—yes, we have the real mascalonge) don't use minnows under three inches, if you can get better ones. A half-pound bass will get away with a five-inch minnow.

When fishing with a short line and no reel, hook your minnow through the back, instead of the mouth, just behind the dorsal fin, being careful not to injure the backbone. The reason is that you have no chance to let your bass run and turn the minnow for swallowing—you must strike quick, while he is holding it by the middle. (Now don't get your own back up, Mr. Angler, this whole chapter is for men in extremity, and sportsmanship has nothing to do with it.)

Frogs often are good bait in still fishing (the only method we are considering), although most favored by bait casters. Use none but small ones; the big fellows are of no account except for your own eating. The young of the common leopard frog is best. Hook him through both lips, from the bottom up, but to one side, so as to miss the artery in the center of the upper jaw. Let the hook come out near one eye; then the frog will wriggle around in trying to right himself. Keep him in motion a good deal, and bring him up now and then for a breathing-spell, or he will drown. Young frogs are to be found from June to August

along the grassy banks of creeks, muddy margins of ponds, around springs, and wet swales. To capture without a net, approach stealthily until within sure reach; then strike swiftly, with fingers outspread.

In May and June, tadpoles can be used with success. The little red newt (often called "spring lizard," although it is not a reptile but a batrachian) is greedily taken by trout and other fish. It abounds in the woods as early as April, under stones and decaying logs or stumps, and comes out in great numbers after warm rains.

Crayfish (generally called "crawfish," by some "crabs") are found under flat stones in shallow water. They shed their hard armor periodically, and are at their best as bait when in the "shedder" stage. In this condition they may be hooked through the body, avoiding the heart, which lies close to the back just forward of where the tail joins the body. When in the hard shell, pass the hook upward through the tail; or, if the hook is too small to project enough in this way, pass it into the shell and out again. Use a float on the line, so as to keep the crayfish a few inches off the bottom, or he will cling like grim death to the first thing he can get hold of. Bass are very fond of crayfish at times.

One of the best natural baits for bass, when the water is clear, is that fierce-looking creature called hellgrammite, dobson, or grampus. This is the larva of a large winged insect, the horned corydalis.

It is found under stones or other submerged objects in shallow, swift-running water. To catch it, turn the stone over, upstream; the hellgrammite then will curl up into a ball and float down into the net or hat held to receive it. Seize it by the sides of the neck, to avoid its sharp pincers, and, holding your hook sidewise so the barb will be horizontal, pass the point under and close up against the hard "collar" on the back of the neck, from behind forward, bringing the hook out just be-

hind the thing's head. A hellgrammite is so tough and tenacious of life that two or more fish may be caught with one of them. Like the crayfish, it should be kept off the bottom by a float or by moving it frequently. The mature corydalis fly can be used as bait, after plucking off its wings, but it it much softer than the larva and does not live long on the hook.

From early spring until June, or even July, it is easy to get "stick bait" (the larva of the caddis fly) in almost any trout stream. This little white grub or creeper, with short black thorax and black head armed with nippers, makes for itself a cylindrical case out of tiny twigs, bits of leaf, sand, etc., stuck together with silk that it secretes, the whole being a good example of protective resemblance, for it looks just like a broken piece of dead twig. Caddis worms, hidden in these cases, strew the bottom of still shallows at the sides of streams, along with trash collected there by the eddies. Pinch off one end of the case, draw the worm out by its head, and impale it on a small trout hook. Fish take it very greedily.

Various other aquatic larvae, such as those of stone flies, drakes, and water beetles, will be found in spring and summer under stones and sticks, or attached to them, in shallow water with rocky or gravelly bottom. Almost any creeper that you find in such a place is good bait.

Throughout the hot summer months the best of all live baits for trout are certain species of grasshoppers. Some of these may be captured even as late as October. There is a little, hard-bodied, green grasshopper, active and hard to catch, that appears early in the season and is a good fish lure at that time; but the later green ones are too soft and pulpy to stay on a hook, and they seldom bring a strike, anyway. Then there are the large, slow-flying, dry-looking locusts that become so numerous late in summer—they are worthless. What the fish want, and will go after, are the medium-sized

'hoppers with darkish, well marked bodies, red or yellow under wings, and a *juicy* appearance. In the dog-days, when trout lie deep in the pools, sluggish and scornful of all other lures, it takes this sort of a grasshopper, kicking madly along the surface, to interest, excite, and compel your big old stager to an athletic contest.

The time to catch grasshoppers is in the early morning, when the grass is still heavy with dew, or after a shower, or by moonlight after the dew has fallen. They are cold and torpid then, and you can pick up a boxful in no time. Common ways of hooking are through the upper part of the thorax, or through the "breastplate" and upward out through the head. Either of these will do in rippling water, though the bait dies quickly; but to provoke a lazy trout from the bottom of a still pool you must give your 'hopper every chance and encouragement to play the gymnast, and keep it up. This he certainly cannot do if impaled through the vitals. Tie a loop of thread around his body, under the wings and just ahead of the hind legs. Then run a small hook, from behind and forward, through this loop, on the under side of the insect's body, so that the bend of the hook hangs straight down between the legs and pointing backward. Harnessed in this way, the grasshopper is uninjured, and he is naturally balanced on the water. Drop him in, as far above the pool as circumstances will permit, and let the current carry him along while he kicks like a fury to rid himself of his incumbrance. It is a lump and a sot of a trout who can stand such a performance over his very nose.

Crickets have the same "season" as grasshoppers, and are used in the same way. You will find them under rocks and logs, or they can be captured in the open after a shower. Bass are not so fond of grasshoppers and crickets as trout are; and yet, in the hot months, there are times when our notional small-mouth will take nothing else.

During the time of frost, bait may be hard to

get; but fish have less choice then, and, correspondingly, are not so fanciful about their diet, when they have any appetite at all. Grubs may be found in decaying tree trunks, down-logs and stumps, which you can kick open or knock to pieces. Many insects hibernate under logs and rocks, loose old bark, rotting leaves, etc., and so do snails and lizards. A warm, thawing day will bring many of them out.

If the wanderer has saved a bit of bacon, he has fish bait ready at hand. Having caught one fish, then he has bait for others by utilizing the "throat latch" (the V of tough skin and tendon directly under the tongue), or a strip of white, glistening fish belly, which he will skitter on the water to imitate the motions of a live minnow. If the skin of a small trout or perch is used, leave the belly fin on.

NIGHT LINES.—If one has enough stout line and hooks, he can set out a trot-line overnight, and stand good chance of fresh fish for breakfast. Methods vary, according to circumstances. Suppose you are on the bank of a river, and have no boat. To one end of your line tie a stone about the size of your fist. Three feet back of it tie on your first snood, and add others at similar intervals—two, three, or more of them. The snood is a bit of line, twelve to eighteen inches long, with a stout hook at the end of it. Coil the rest of the line neatly on the bank and tie its near end to a stake driven firmly into the ground. Bait the hooks, as directed below. Now get a forked stick as long as a broom-handle, poke its crotch under the stone, and heave the line into the stream. In this way there is no danger of hooking your hand when throwing. The stick gives extra leverage; so don't throw too hard, or you will outrun your line and break it. If there is slack line left, draw it in until you feel the tug of the stone anchor. Then drive a limber stick in front of your stake, split its top, and draw your line through the split to keep all

taut. If a fish hooks itself while you are by, you will know it by the jerking of the trigger stick. Then haul in and bait afresh. In this way we used to catch barrels of catfish, redhorses, buffaloes, and white suckers, when I was a kid, out West. We would set out several trot-lines, put a ball of mud on each trigger stick, go off skylarking, come back, and—wherever a mud ball had tumbled off we knew we had a fish!

If minnows or crawfish or hellgrammites are used as bait, or if the bottom is rough, it is a good plan to float the hooks of a trot-line a few inches off the bottom. This also keeps the bait in sight of passing fish. A split cork, or a bit of light wood, about four inches back of each hook, will do the business.

For bait on a set-line you can use anything that fish will eat, and this is a broad order, since most of your catch will be ground-feeders who are not at all fastidious. For catfish one of the best baits is raw, red meat. Entrails and other offal of animals you may have snared will do very well. Soft or delicate bait, such as liver, should be threaded on the hooks, or inclosed in a bit of mosquito netting, if you should chance to have any. This hinders turtles and eels from stealing the bait.

Lacking a long line, you can tie short "bush lines," here and there along the bank at likely places, to limbs of projecting trees, or to poles securely planted in the bank. It pays to take up the outlines several times during the night, to re-bait, and to get fish or turtles that might break away if left on too long.

FROGS.—Hitherto we have considered frogs only as bait. Let my revered and oft-quoted mentor "Nessmuk" tell how to get them for the pan. A man without equipment can easily extemporize all that is needed.

"And when fishing is very poor, try frogging. It is not sport of a high order, though it may be called angling—and it can be made amusing, with hook and line. . . . There are several modes of taking the

festive batrachian. He is speared with a frog-spear; caught under the chin with snatch-hooks; taken with hook and line; or picked up from a canoe [or ashore] with the aid of a headlight, or jack-lamp. The two latter modes are best.

To take him with hook and line: a light rod, six to eight feet of line, a snell of single gut with a 1-0 Sproat or O'Shaughnessy hook, and a bit of bright scarlet flannel for bait; this is the rig. To use it, paddle up behind him silently, and drop the rag just in front of his nose. He is pretty certain to take it on the instant. Knock him on the head before cutting off his legs. . . .

"By far the most effective manner of frogging is by the headlight on dark nights. To do this most successfully, one man in a light canoe, a good headlight, and a light, one-handed paddle, are the requirements. The frog is easily located, either by his croaking or by his peculiar shape. Paddle up to him silently and throw the light in his eyes; you may then pick him up as you would a potato. I have known a North Woods guide to pick up a five-quart pail of frogs in an hour, on a dark evening. On the table, frogs' legs are usually conceded first place for delicacy and flavor. . . . And, not many years ago, an old pork-gobbling backwoodsman threw his frying-pan into the river because I had cooked frogs' legs in it. While another, equally intelligent, refused to use my frying-pan because I had cooked eels in it; remarking sententiously, 'Eels is snakes, an' I know it.'"

"Small Deer."—It goes without saying that men traveling through a barren region cannot be fastidious in their definition of "game." All's meat that comes to a hungry man's pot. A few words here may not be amiss as to the edible qualities of certain animals that are not commonly regarded as game, but which merit an explorer's consideration from the start; also as to some that are not recommended.

Probably most sportsmen know that 'coon is not bad eating, especially when young, if it is properly prepared; but how many would think to remove the scent-glands before roasting a 'coon? These glands should be sought for and extracted from all

animals that have them, before the meat is put in the pot. Properly dressed, and, if necessary, parboiled in two or three waters, even muskrats, woodchucks, and fish-eating birds can be made palatable. (See Vol. I., pp. 281, 313, 316, 318.)

Prairie-dog is as good as squirrel. The flesh of the porcupine is good, and that of the skunk is equal to roast pig. Beaver meat is very rich and cloying, and in old animals is rank; but the boiled liver and tail are famous tid-bits wherever the beaver is found. A man would have to be hard pressed to tackle any of the other fur-bearers as food, excepting, of course, bear and 'possum.

The flesh of all members of the cat tribe, wildcats, lynxes, and panthers, is excellent. Doctor Hart Merriam declares that panther flesh is better than any other kind of meat. The Englishman Ruxton, who lived in the Far West in the time of Bridger and the Sublettes and Fitzpatrick, says: "Throwing aside all the qualms and conscientious scruples of a fastidious stomach, it must be confessed that dog meat takes a high rank in the wonderful variety of cuisine afforded to the gourmand and the gourmet by the prolific mountains. Now, when the bill of fare offers such tempting viands as buffalo beef, venison, mountain mutton, turkey, grouse, wildfowl, hares, rabbits, beaver-tails, etc., etc., the station assigned to dog as No. 2 in the list can be well appreciated—No. 1, in delicacy of flavor, richness of meat, and other good qualities, being the flesh of panthers, which surpasses every other, and all put together."

Lewis and Clark say of dog flesh: "The greater part of us have acquired a fondness for it. . . . While we subsisted on that food we were fatter, stronger, and in general enjoyed better health than at any period since leaving the buffalo country." Again they say: "It is found to be a strong, healthy diet, preferable to lean deer or elk, and much superior to horse flesh in any state." Many other travelers and residents in the early West commended

dog meat; but the animals that they speak of were such as had been specially fattened by the Indians for food, and not starved and hard-worked sledge animals.

One who was driven by starvation to eat wolf's flesh says that it "tastes exactly as a dirty, wet dog smells, and it is gummy and otherwise offensive." But it seems that tastes differ, or, more likely, that all wolves are not alike. Ivar Forsheim of Sverdrup's second Norwegian polar expedition says: "They were two she-wolves in very much better condition than beasts of prey usually are, with the exception of bears. The fat really looked so white and good that we felt inclined to taste it, and if we did that, we thought we might as well try the hearts at the same time. Although most people will consider this a dish more extraordinary than appetizing, I think prejudice plays a large part here; as, at any rate, we found the meat far better than we expected."

I am assured by more than one white man who has eaten them that the flesh of snakes and lizards is as good as chicken or frogs' legs. One of my friends, however, draws the line at the prairie rattler. Once when he was on the U. S. Geological Survey he came near starving in the desert, and had to swallow his scruples along with a snake diet. "Probably," he said, "a big, fat diamond rattler might be all right, but the little prairie rattler is too sweetish for my taste; it's no comparison to puff-adder; puff-adder, my boy, is out of sight!"

This much I can swallow, by proxy; but when Dan Beard speaks approvingly of hellbenders as a side dish, I must confess that I'm like Kipling's elephant when the alligator had him by the nose: "This is too buch for be!"

Another of my acquaintances assured me that the prejudice against crow (real *Corvus*) is not well founded, and I found by testing that he was in the right. The great gray owl is good roasted, despite what it may be when "biled." The flesh of

the whippoorwill is excellent. Turtles' eggs are better than those of the domestic fowl (soft-shell turtles deposit their eggs on sandbars about the third week in June).

It is the testimony of gourmets who survived the siege of Paris that cats, rats, and mice are the most misprized of all animals, from a culinary point of view. "Stewed puss," says one of them, "is by far more delicious than stewed rabbit. . . Those who have not tasted *couscoussou* of cat have never tasted anything."

Anyway, who are we, to set up standards as to the fitness or unfitness of things to eat? We shudder with horror at the idea of eating dog or cat, but of such a downright filthy animal as the pig we eat ears, nose, feet, tail, and intestines. How about our moldy and putrid cheeses, our boiled cabbage and sauerkraut, raw Hamburgers and "high" game? The hardihood of him who first swallowed a raw oyster! And if snails are good, why not locusts, dragon flies, and the like? I tell you from experience that when you get to picking the skippers out of your pork, and begrudge them the holes they have made in it, you will agree that any kind of fresh, wild meat that is not carrion is clean and wholesome. Caspar Whitney, after describing his menu of frozen raw meat in the Barren Grounds, says: "I have no doubt some of my readers will be disgusted by this recital; and as I sit here at my desk writing, with but to reach out and press a button for dinner, luncheon—what I will—I can hardly realize that only a few months ago I choked an Indian until he gave up a piece of muskox intestine he had stolen from me. One must starve to know what one will eat."

I trust that none of my readers may be cast down by reading these somewhat lugubrious pages. After all, it is not so bad to learn new dishes; but think of the predicament of that poor wight—he was a missionary to the Eskimo, I believe—who, being cast

adrift on an ice floe, and essaying to eat his boots, did incontinently sneeze his false teeth into the middle of Baffin's Bay!

IN EXTREMIS.—The Far North is Famine Land, the world over, and to it we must look for examples of what men can subsist on when driven to the last extremity.

In all northern countries, within the tree limit, it is customary, in starving times, to mix with the scanty hoard of flour the ground bark of trees. It is possible to support life even with bark alone. The Jesuit missionary Nicollet reported, more than two centuries ago, that an acquaintance of his, a French Indian-agent, lived seven weeks on bark alone, and the *Relations* of the order, in Canada, contain many instances of a like expedient. Those were hard times in New France! Such an experience as this was dismissed with a single sentence, quite as a matter of course: "An eelskin was deemed a sumptuous supper; I had used one for mending a robe, but hunger obliged me to unstitch and eat it." Another brother says: "The bark of the oak, birch, linden, and that of other trees, when well cooked and pounded, and then put into the water in which fish had been boiled, or else mixed with fish-oil, made some excellent stews." Again: "they [the Indians] dried by a fire the bark of green oak, then they pounded it and made it into a porridge." It seems that the human stomach can stand a lot of tannin, if it has to do so.

The young shoots of spruce and tamarack, the inner bark (in spring) of pine, spruce, and hemlock, young leaf-stems of beech, hickory and other trees, the buds of poplar, maple and wild rose, and the young leaves and flowers of basswood are nutritious; but these can be had only, of course, in spring. Far better than oak bark are the inner barks of alder, quaking aspen, basswood, birch, sweet bay, cottonwood, slippery elm (this especially is nutritious),

white elm, pignut hickory, yellow locust, striped maple, poplar, and sassafras. The Chippewas boil the thick, sweetish bark of the shrubby bittersweet or staff-tree (*Celastrus scandens*) and use it for food. Young saplings of white cedar have a sweet pith of pleasant flavor which the Ojibways used in making soup.

The following entry in the diary of Sir John Franklin sounds naive, when stripped of its context, but there is a world of grim pathos back of it: "There was no *tripe de roche,* so we drank tea and ate some of our shoes for supper." The rock tripe here referred to (*Umbilicaria arctica* or *Dillenii*) is one of several edible lichens that grow on rocks and are extensively used as human food in lands beyond the arctic tree limit. Reindeer moss (*Cladonia rangiferina*) and the well-known Iceland moss (*Cetraris Icelandica*) are other examples. These are starchy, and, after being boiled for two or three hours, form a gelatinous mass that is digestible, though repulsive in appearance, one of the early Jesuits likening it to the slime of snails, and another admitting that "it is necessary to close one's eyes to eat it."

CHAPTER XXIII

ACCIDENTS AND EMERGENCIES: THEIR BACKWOODS TREATMENT

The present chapter is boiled down for the use of men of little or no surgical experience, who may suddenly find themselves wounded, or with an injured companion on their hands, when far away from any physician.

In operating upon a comrade, the main things are to keep cool, act promptly, and make him feel that you have no doubt that you can pull him through all right. Place him in a comfortable position, and expose the wound. If you cannot otherwise remove the clothing quickly and without hurting him, rip it up the seam. First stop the bleeding, if there is any; then cleanse the wound of dirt (but do not wash it); then close it, if a cut or torn wound; then apply a *sterilized* dressing; then bandage it in place. Of course, if the injury is serious, you will immediately send a messenger hot-foot for a surgeon, provided there is any chance of getting one.

As for the patient himself, let him never say die. Pluck has carried many a man triumphantly through what seemed the forlornest hope. Let me take space for an example or two.

Kit Carson once helped to amputate a comrade's limb when the only instruments available were a razor, a handsaw, and the kingbolt of a wagon. Not a man in the party knew how to take up an artery. Fine teeth were filed in the back of the saw, the iron was made white-hot, the arm was removed, the stump seared so as to close the blood-

vessels, and—the patient recovered.

Charles F. Lummis, having fractured his right arm so badly that the bone protruded, and being alone in the desert, gave his canteen strap two flat turns about the wrist, buckled it around a cedar tree, mounted a nearby rock, set his heels upon the edge, and threw himself backward. He fainted; but the bone was set. Then, having rigged splints to the injured member with his left hand and teeth, he walked fifty-two miles without resting, before he could get food, and finished the 700-mile tramp to Los Angeles with the broken arm slung in a bandanna.

Richardson tells of a Montana trapper who, having his leg shattered in an Indian fight, and finding that gangrene was setting in, whetted one edge of his big hunting knife, filed the other into a saw, and with his own hands cut the flesh, sawed the bone, and seared the arteries with a hot iron. He survived.

First-aid Materials.—Many of the operations hereinafter described can be performed with extemporized materials; but antiseptics and sterilized dressings, ready at all times for instant use, are so essential in the treatment of wounds and other injuries, that every wise traveler will carry on his person some sort of first-aid packet. Even if this be nothing more than one of the Red Cross dressings for small wounds and a few antiseptic tablets, sealed up in a waterproof and greaseproof envelope, which weighs practically nothing and takes up hardly any room, it may make all the difference between a quick cure and long suffering or death from blood-poisoning. The pocket emergency case that I mentioned on page 103, along with a soldier's first-aid packet for major injuries, are sufficient to give emergency treatment in any case, yet the two together weigh less than half a pound and can be carried in a coat pocket.

Dressings.—Roller bandages are not recommended, save to men already trained to use them properly. Anybody, on the other hand, can apply the small ready-to-use Red Cross dressings, and adhesive plaster for strapping them on where they cannot be tied. For large wounds, the triangular bandage in a soldier's packet is easy for anyone to use, as there are cuts and directions printed on it showing how to apply it to any part of the person.

A roll of adhesive plaster (zinc oxide plaster) is almost indispensable; but never apply it directly to a wound—first cover the hurt with a sterilized pad.

Court plaster, although the commonest of first-aid dressings, is the poorest. It is likely to be surgically unclean, and has no antiseptic properties, but, on the contrary, it seals up the wound so as to confine whatever germs may have invaded it—the very worst thing it could do, for it defeats Nature in her effort to get rid of the poison by suppuration. Flexible collodion ("new skin") is likely to do the same thing, unless the cut or abrasion is first sterilized with a strong antiseptic.

Never turn a compress (or other dressing) over and use the other side; it is infected.

Antiseptics.—Such dressings, however, are not enough in themselves to cleanse wounds and keep them free from infection. A supply of some good antiseptic is indispensable in the kit. Those commonly used in domestic practice are either bulky liquids, impracticable on a "go-light" trip, or ineffective powders, like boric acid, that are only soothing, not really germicidal.

Mercury bichloride (corrosive sublimate) is a powerful agent, but it is so corrosive that it does not make fit solutions in metal vessels, which are all that a woodsman or explorer has. Besides, it is a deadly poison. Carbolic acid in solution is too bulky, and the full-strength liquid is mean to carry on a rough trip.

Hitherto I have recommended iodine; but a bottle of it will make a sad mess of things if it leaks or breaks; an ampule in the pocket case serves for but one treatment, and, being in a wooden tube, is bulky in proportion. Iodine is poisonous, corrosive, painful in use, and impossible on delicate tissues. It has the further disadvantage that it clots blood serum, and so cannot penetrate a punctured wound unless the hole is slit open with a knife.

Thanks to the discoveries of Dr. Carrel, with calcium hypochlorite, in the military hospitals of France, and of Dr. Dakin, who has produced a chlorine-carrier that does not deteriorate, we now have what seems to be the ideal antiseptic. I am at present using Dakin's antiseptic, as made here under the trade name of chlorazene. It is put up in tablet form. Chlorazene is neither poisonous nor corrosive in any marked degree. It can be employed, in proper solution, anywhere, even in the eye, as well as for sterilizing instruments and the hands of the operator. Yet it is one of the most powerful of all known antiseptics.

Stimulants.—In many accidents a stimulant is required. Don't carry whiskey—if you don't drink it up yourself the first time you feel bad, then someone will surely steal it. For the camp medical kit, get a bottle of pure grain alcohol. Put a fake label on it—"Antiseptic—Poison"—with a death's-head that even a savage will understand. For internal use, give a teaspoonful of it in three times the quantity of water. For dressing wounds, or giving an alcohol rub, use three parts alcohol to two of water; for a sprain, half-and-half.

Another good and quickly diffusible stimulant is aromatic spirits of ammonia, one teaspoonful in half a glass of water. It is useful for various other purposes that will be mentioned later.

No liquid can well be carried in a pocket emergency case; but there is room for a few strychnine

sulphate tablets to be used as a heart tonic and nerve bracer in case of snake bite, shock, exhaustion, alcoholism, or as may otherwise be needed. The dose is 1-30 grain hypodermically or 1-20 grain by mouth.

Emetics.—To treat poisoning, and some other ailments, an emetic is required. A tablespoonful of salt, or of dry mustard, in half a pint of lukewarm water, will serve the purpose. Repeat if necessary.

Liniments and Lotions.—Most of the "patent" liniments are humbugs, considering the claims made for them. Treatment with heat or cold, as the case may be, is far more curative, nine times out of ten, and an alcohol rub will take good care of the other tenth.

An excellent astringent lotion for sprains and bruises can be prepared by dissolving in water one or more tablets of lead acetate and opium, which are small enough for the emergency kit.

Wherever witch hazel grows, one can make his own decoction (strong "tea") of the bark; it is also good as a poultice. The inner bark of kinnikinick, otherwise known as red willow or silky cornel, makes a good astringent poultice for sprains and bruises.

Ointments.—These seldom are good applications for wounds. Grease attracts and holds dirt; dirt breeds infection. But there is proper use for some zinc ointment, resinol, unguentine, or carbolized vaseline, in cases of skin affections, sunburn, ivy poisoning, erysipelas, blistered feet, and so on.

Extemporized Dressings.—In case no regular antiseptic is at hand, there are pretty good wound dressings to be found in the woods. Balsam obtained by pricking the little blisters on the bark of balsam firs is one of them. Others are the honey-like gum of the liquidambar or sweet gum tree, raw turpentine from any pine tree, and the resin procured by boxing (gashing) a cypress or hemlock

tree, or by boiling a knot of the wood and skimming off the surface. All of these resins are antiseptic, and the first two are soothing.

Poultices may be needed to relieve the tension of an inflamed part and to hasten suppuration ("draw the pus to a head"). They have no other curative effect than hot-water compresses, but act more efficiently because they hold the heat better and do not require so frequent renewal. A poultice is easily made from cornmeal or oatmeal (flaxseed is not supposed to be in the kit). Mix by stirring a little at a time into boiling water, making a thick paste free from lumps; then spread on cloth to a thickness of ½-inch, leaving a 1½-inch margin all around for folding in. The poultice should be made thoroughly antiseptic by dissolving tablets in the water. To prevent it from sticking, grease the part or smear it with oil. Then put on the poultice and, if convenient, cover with a waterproof material. Remember that a cold poultice does no good whatever, and that an old one should not be reheated—make a new one. Renew a large poultice every four or five hours, a small one every one or two hours.

The woods themselves afford plenty of materials for good poultices. Chief of these is slippery elm, the mucilaginous inner bark of which, boiled in water and kneaded into a poultice, is soothing to inflammation and softens the tissues. Good poultices can also be made from the soft rind of tamarack, the root bark of basswood or cottonwood, and many other trees or plants. None of these should be spread more than ¼-inch thick. Our frontiersmen, like the Indians, often treated wounds by merely applying the chewed fresh leaves of alder, striped maple (moosewood), or sassafras. You may remember Leatherstocking (he was "Hawkeye" then) advising a wounded companion that "a little bruised alder will work like a charm." Saliva carries germs: so don't chew but bruise the leaves.

A poultice of the leaves of the common plantain weed is a first-rate application for burns, scalds, bruises, erysipelas, and ivy poisoning. The powdered leaf applied as a paste, or simply the dry leaf powdered, stops bleeding in a short time.

Mustard plasters are used as counter-irritants. A strong one is made of equal parts of dry mustard and flour; for gentler effect use less mustard in proportion. Make into a paste with lukewarm water, and spread between layers of thin cloth. Leave it on 15 to 20 minutes, or until the skin is well reddened.

Heat and Cold.—Direct application of heat is one of the prime resources of first-aid. A canteen will do instead of a hot-water bag, or a hot stone may be rolled in blanketing or other thick cloth; but a better expedient, because it shapes itself to whatever part it is applied to, is a bag partly filled with hot sand, salt, rice, or the like. The stuff may be heated quickly in a frying-pan. If the patient is unconscious, you must be careful not to burn him. Observe his skin, frequently, and feel the cover of the hot article, which should not rise above 115 deg.

To produce the most effect, heat should be applied between the thighs, between the arms and the body, and to the soles of the feet. Cloths wrung out in hot water, then inclosed in dry ones, are the best means to reduce swelling after an injury.

Cold is used also to reduce swelling, as well as to stimulate breathing, and to reduce temperature in sunstroke. Of course, ice cannot be obtained in the wilderness, save in winter, but, if the affected part cannot be soaked in a running stream, then cloths may be wrung out in water from a spring or cold brook, or an arrangement can be rigged to discharge a continuous stream of it upon the patient.

UNCONSCIOUSNESS.—If you should find a person lying in a stupor or quite unconscious, seek the cause, before treating him, or you may do more

harm than good. If it be a case of drowning or freezing, you will know at once. Sunstroke is marked by a hot, dry skin. Bleeding, bruises, and swelling speak for themselves. If, however, there are none of these symptoms, examine the patient with care.

Observe, first, whether the face is pale or flushed. If pale, and the pupils of the eyes are natural, it is a simple case of fainting; if the pupils are dilated, the face pale, with cold sweat, the pulse weak and quick, probably there has been concussion of the brain.

On the other hand, a flushed and turgid face, respiration snoring, a slow and full pulse, are symptoms common to apoplexy, drunkenness, and opium poisoning. It is very important to distinguish between these. Odor of liquor in the breath is not conclusive; for a person struck down by apoplexy may have been drinking. A drunken man may have fallen and suffered concussion of the brain, thus complicating the case.

In apoplexy due to hemorrhage in the brain, one side of the patient generally is paralyzed. He cannot be aroused, even with ammonia to the nose. His *eyeballs* are *not sensitive* to touch. A man drunk or "doped" generally can be aroused for a moment by dashing cold water in his face. A bottle of liquor, laudanum, or morphine, is likely to be found on or near him. In alcoholic poisoning the pupils are dilated and equal; in opium poisoning, they are extremely contracted.

Drowning.—Clean any mud or water from the mouth with a handkerchief on the finger, loosen all tight clothing, and expose the chest and waist. Slip your hands under the man's waist and lift him high enough for his head to hang down and drain the water out of him. Give two or three quick, smarting slaps on his naked chest with the open hand. If this fails to restore breathing, then start at once

to perform artificial respiration. The best way for an inexperienced person, or for one who has to work alone, is what is called the "prone-pressure method," as follows:

Turn the patient face downward on the ground, arms extended above the head, *face to one side*. If his tongue does not fall forward, grasp it with a handkerchief and pull it out, so that air may enter.

Kneel astride of him, and grasp him firmly on both sides of the chest, just above lower margin of ribs. Press steadily and *heavily* downward and forward, for three seconds, to expel the air from the lungs. Then, gradually (two seconds) release the pressure. The elasticity of the chest makes it expand and draw air into the lungs. Repeat this operation with a regular rhythm of 12 to 15 to the minute. You will conserve your own strength by swinging your body forward and backward so as to let your weight fall vertically upon the wrists and then be released.

While you are doing this, if there is an assistant, have him remove the patient's wet clothing, dry him *without* rubbing, and cover him with a dry blanket or articles of clothing; but do not let this interrupt your own work for a single moment. Do not rub nor apply heat to restore circulation until natural breathing has been established; to do so might be fatal.

Continue this treatment until the subject shows signs of life; then, with more gentle pressure, until the breath comes naturally. There must be no let up. Two or more helpers can work in relays, changing about without losing the "stroke." In most cases the patient revives within thirty minutes; but it may take an hour or two of continuous work to restore life. Do not be discouraged.

As soon as natural breathing has been restored, rub the person's limbs and body with firm pressure *toward the heart*, to bring back circulation. Now

wrap him in warm blankets and apply hot stones or other dry heat, as described early in this chapter. When he can swallow, give him hot stimulants, a little at a time. Then let him sleep.

Rescue of the Drowning.—In case you must swim for the drowning person, then, if possible at the moment, take with you a float of some sort for him to cling to. It takes only a small buoyant object to support a man's head above water. Cast off at least your shoes before striking out.

When you get near, shout cheerily that you will get him out all right if he does not struggle. But a drowning person is likely to get frantic, as soon as water enters his lungs, and grasp desperately at a rescuer. So be cool and wary. You must manoeuvre for position, lest he drown you both. If he sinks once or twice, little harm will be done—it may even be for the best. The first two sinkings are very slow, and he does not go down deep.

Get at him *from behind,* if possible. If he turns on you and tries to seize you, reach your left arm forward and push him away with your hand against his lower jaw. He may succeed in gripping your arm: in that case, turn so as to get your foot under his chest, and push him away with a powerful kick. If he should be strong enough, however, to hold you in a grip that you cannot loosen, then take a good breath and sink with him. You can stand it longer than he can; his hold will relax before your own air gives out. The "death grip" that never loosens is common in fiction, but rarely, if ever, in fact. In the unlikely event that he should hold out longer than you consider safe, strike him in the face and break loose. This sounds brutal, but it may be the only way to save him, and yourself, too.

If the person is tractable, or has weakened until no longer dangerous, get him by the hair, or by an inside hold on the collar, and, swimming ahead of

him on your back or side, tow him out. If he is naked and short-haired, then, if he is not insanely struggling, he can be rescued by approaching from behind, rolling him suddenly on his back, turning on your own back, partly under him, and drawing his head up on your chest. A child or woman, even though struggling, may be managed in this way if you seize one of the wrists and pull it behind the person's head. Then swim out on your back.

When a drowning man has sunk to the bottom, in smooth water, his exact position is shown by air bubbles that occasionally arise.

If some one has broken through the ice, and there is no plank nor rope to be had, lie down flat on your belly and crawl out near enough to reach him a stick or toss one end of your coat to him. Then back out, still lying flat, so as to distribute your weight over as much surface as possible, and pull while he helps himself as well as he can.

Cramp while Swimming.—This may result from going into the water too soon after eating, or when overheated, or from staying in so long as to become chilled. It is not serious for a swimmer who keeps his wits, but if he gets frightened it may cost his life. Turn on your back and keep your chest inflated. Float, and swim with the unaffected limbs. Even if you be far from shore, the cramped member may soon relax if you keep cool.

Suffocation.—If a person has suffocated from inhaling gas or smoke, or from choking or hanging, get him into the fresh air as quickly as possible, loosen his clothing, sprinkle cold water on face and bare chest, and, if he still fails to breathe, perform artificial respiration as for drowning. Then apply heat and give a stimulant.

Fainting.—If attacked with vertigo, bend your head down so it is between the knees, to help the blood into it; do not keep this up if not promptly effective. Cold air, and sprinkling with cold water often prevents fainting.

If one has fainted, take him into the fresh air and lay him on his back, with *feet higher than head* (unless the face is flushed or blue). Loosen the clothing. Spatter the face and chest with cold water. Rub limbs toward the heart. Apply ammonia to the nose. When consciousness has returned, give a stimulant, or put the patient to bed and apply heat.

Never raise a fainting person to a sitting posture.

SHOCK.—In case of collapse following an accident, operation, or fright: treat first as for fainting. Then wrap the person in blankets, apply heat, and rub his limbs toward the body, keeping him well wrapped up the while. If he is conscious, and *not bleeding* externally or internally, give him hot tea or coffee, or just one good drink of liquor, or ammonia. But if the shock is from an injury and attended by bleeding, the first thing to do is to check the flow of blood.

Stunning (Concussion of the Brain).—Lay the man on his back with head somewhat raised. Hot water poured on his head will help to arouse him. Apply heat as for shock, but keep the head cool with cold wet cloths. Rub his limbs. Ammonia may be held under the nose, but do not give any stimulant: that would drive the blood to the brain, where it is not wanted. Keep the patient quiet. Light diet and laxatives.

LIGHTNING STROKE.—If the heart has stopped, the case is fatal. If not, but breathing is suspended, practice artificial respiration for at least half an hour, and other treatment as for drowning. Electric burns are treated like any other.

SUNSTROKE.—Observe the difference between this and heat exhaustion (see below). In sunstroke proper the face is red, the skin very hot and dry, and the subject is quite unconscious. Lay him in a cool place; position same as for stunning. Remove as much of his clothing as practicable. Hold a vessel or hatful of cold water four or five feet above

him, and pour a stream first on his head, then on his body, and last on his extremities. Continue until consciousness returns. If this cannot be done, then rub cold cloths over face, neck, chest, and armpits. Hold ammonia under the nose. When the patient becomes conscious, let him drink cold water freely, but no stimulants.

Heat Exhaustion.—Generally the person is conscious, but very depressed and weak. His face is pale and covered with clammy sweat. Do not apply cold externally, but let him sip cold water. Give a little strong black coffee, or a mild stimulant. Let him rest in bed.

Apoplexy.—When a blood-vessel bursts in the brain, the subject falls unconscious. The face is flushed, lips blue, eyelids half open, eyes insensitive to touch, respirations snoring, pulse full and slow, skin usually cool. Generally one side of the body is paralyzed. The case may or may not be fatal.

Lay the patient in bed with head and shoulders propped up. Apply cold cloths to the head and heat to the limbs. No stimulants. Absolute quiet and rest.

Alcoholism.—If you find a man lying apparently dead drunk, make sure, first, that it is not a case of apoplexy.

Usually a dash of cold water in the face will rouse a drunken man. Make him vomit. Then a cup of hot coffee will aid to settle the stomach and clear the mind. To sober quickly, and brace him up, administer a teaspoonful of aromatic spirits of ammonia in half a cup of water.

If the skin is cold and clammy, lay him in a comfortable position, apply dry heat, keep the man covered, and rub his limbs toward the body to increase circulation. Keep the bowels open. Feed first with concentrated broth or soup well seasoned with red pepper. Give him some liquor at judicious intervals, if it can be procured (to deny it is

a brutality of ignorance) until he gets on his feet. But if there is none, give him red pepper tea (enough cayenne steeped in hot water to make the stomach tingle). This braces his nerves and helps to avert "the horrors."

If threatened with collapse, apply heat, and inject strychnine.

In delirium tremens, watch the patient carefully, that he may not injure himself or others, or commit suicide; but avoid physical restraint as far as possible. The serious symptoms are due chiefly to sleeplessness, which is to be combatted with such means as you have at hand. Try trional, veronal, or a bromide, if you can get them. An opiate is the last resort. If the heart weakens, give ammonia or strychnine.

Fit or Convulsion.—Kneel by the patient's head place one arm under it, and undo collar and belt. Insert in the mouth something that he cannot swallow, such as a stick, or a pocket-knife wrapped in handkerchief, to prevent the tongue from being bitten. Get him away from anything against which he might strike and injure himself, but do not try to open his hands or restrain his movements. When the attack has passed, do not rouse, but let him sleep, with warmth to the feet.

Hysteria.—Do nothing. Appear quite indifferent. A show of sympathy will only make matters worse.

Ptomaine Poisoning.—The exciting cause is eating certain varieties of food that have partly putrefied, such as meat, sausage, fish, shellfish, cheese, and especially, in the case of campers, canned meats, etc., that have spoiled.

It is distinguished from cholera morbus by marked nervous symptoms (twitching of facial muscles, tingling sensations, dilated pupils, breathlessness, dizziness, perhaps convulsions) and usually a low temperature.

Cause repeated vomiting by giving three or four glasses of warm water, each containing salt or mustard. Then give stimulants to support the heart and nerve force. Put the victim to bed, with head low, and apply dry heat. If a syringe can be procured, empty the lower bowel with an injection of soapsuds and water. After a thorough cleaning out, give an intestinal antiseptic.

Poisoning from Mushrooms (or from unknown plants)—Treat as for ptomaine poisoning. In case of mushroom poisoning, if the patient can swallow, get some charcoal from the camp-fire, powder and administer it. This may absorb much of the poison. Castor oil is the best purgative, to be followed by a soapsuds enema. Atropine by injection, if you have it; otherwise, unless you can get a physician within two or three hours, the chance of recovery is slight; but do your best.

Snake Bite.—The only dangerous snakes in the United States are the rattlesnake, the copperhead, and the cottonmouth moccasin. The small coral snake (harlequin, bead snake) of the Gulf states, and the Sonoran coral snake of New Mexico and Arizona, are somewhat venomous, but their bite is not fatal to a healthy adult. The Gila monster of the Southwest is a dangerous lizard—the only one that is venomous—but can scarcely be provoked to bite.

All other snakes and lizards of our country and Canada are harmless—their bite is no more to be feared than that of a mouse. The notion that the bite of our so-called "puff-adder," "spreading adder," "blowing viper," must be dangerous, because the snake puffs up its neck and hisses like a goose, or that the common watersnake is a moccasin and consequently venomous, is all moonshine, like the story of the hoop-snake and the snake with a poisonous sting in its tail.

However, that other notion that a rattlesnake's bite is not a serious matter is moonshine, too. Men

who know nothing about other rattlers than the little prairie rattlesnake are not competent to express an opinion on the subject.

A bite from any venomous snake is dangerous, *in proportion to the size of the snake,* and to the *amount of venom that enters the circulation.* A bite that does not pierce an important blood vessel is seldom fatal, even if no treatment is given, unless the snake be quite large.

The rattlesnake, copperhead, and cottonmouth are easily distinguished from all other snakes, as all

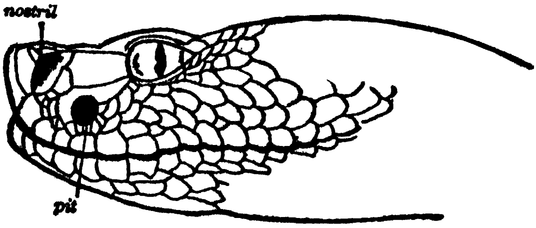


Fig. 192.—Head of rattlesnake (after Stejneger)

three of them bear a peculiar mark, or rather a pair of marks, that no other animal possesses. The mark is the *pit,* which is a deep cavity on each side of the face between the nostril and the eye, sinking into the upper jawbone. Its position is shown in the accompanying cut (Fig. 192). All of them have an upright elliptical, instead of round, pupil in the eye.

All venomous snakes have fangs, and no harmless ones have them. The fangs are in the upper jaw only. In the coral snakes they are permanently erect, but in the other venomous snakes here named they lie flat against the roof of the mouth, when not in use, pointing backward, and are erected by the reptile in striking. They are long, slender, sharply pointed, perforated like a hypodermic needle, and connected by a duct with the venom glands which lie behind the eyes. Auxiliary fangs lie in a sac underneath the regular fang on each side, and, in case

the latter is broken off or extracted, a new fang will be ready for business within a few days.

Here are a few characteristics of the pit vipers, as our three deadly snakes collectively are called:

1. *Copperhead* (also called deaf adder, upland moccasin, pilot snake, chunk head).—A small snake, 2 to 3 feet long, with moderately thick body, broad and triangular head quite distinct from the neck, tail short, dark colored, and pointed. Color of back, a bronze hazel or light reddish brown; with 15 to 20 darker bands, which are narrow on the back and expand to wide blotches on the flanks, the shape being somewhat like that of a dumb-bell with very short handle. Head, a bright copper-red, with two small dark-brown spots close together on the forehead at upper part of head-shield, and with a cream-colored band around the mouth.

The copperhead inhabits the mountainous and hilly regions from Massachusetts southward to the Gulf, and westward (south of Michigan, Wisconsin, Iowa, and Nebraska) to Kansas, Oklahoma, and Texas.

Its venom is as deadly as that of the rattlesnake, but it is not secreted in as large quantity as that of the larger rattlers; consequently the wound is not likely to be so serious. Still, the copperhead is a particularly dangerous creature, because it gives no warning of its presence, nor, according to my observation, does it try to get out of the way, but holds its ground and springs at any intruder.

Only one species.

2. *Cottonmouth moccasin* (water moccasin).—A larger snake, ordinarily about 3 ft., sometimes 4 ft. long. Stout body, head shaped like that of the copperhead and similarly distinct from the neck. Back brown, reddish, or olive, with 11 to 15 rather inconspicuous bars, or pairs of bars, of dark brown, with light centers on each flank. Tail short, pointed, and dark brown or banded. Belly brownish-yellow mottled with dark blotches.

Habitat, North Carolina southward to the Gulf, westward through Kentucky, southern Illinois, and Missouri, to Oklahoma and eastern Texas.

Not so poisonous as the larger kinds of rattlesnakes, but still dangerous to human life. Quite numerous in the southern states. More aggressive than the rattlesnake, striking at everything within reach; but usually rather deliberate about striking, first opening its mouth widely for some seconds, as if to intimidate, and showing the white interior (hence the name "cottonmouth"). Usually found near water, and often on low limbs overhanging the water.

Only one species. The other so-called "moccasins" are either the copperhead or harmless snakes.

3. *Rattlesnake.*—Of rattlers we have no less than sixteen species, but only two of them, the massasauga and the banded or timber rattlesnake, are found in the eastern and central states. The little prairie rattlesnake, which is not very dangerous, is abundant on the plains west of the Missouri River. The great diamond rattlesnake of the South, which sometimes grows to a length of nearly nine feet, is the most formidable member of this group. The small ground rattlesnake of the southern states is aggressive, and gives only a faint warning, and on this account is more dreaded by the negroes than the larger species; but its bite is seldom fatal to grown people. The other species are confined to the Southwest and the Pacific coast.

Rattlesnakes are easily identified by their rattles. These generally last only long enough to become 8 or 10 jointed. Rattles with as many as 15 to 18 joints are quite rare. The number of rattles does not indicate the snake's age. Their office is not clearly understand. Doctor Stejneger says: "They are a substitute for a voice."

When a rattlesnake sees a man approaching, it generally lies quiet to escape observation, so long as

it thinks itself concealed. It seldom strikes unless provoked. If alarmed when it is wide-awake, it nearly always springs its rattle before striking, the sound being very similar to that made by our common "locust" or cicada. If the reptile is trodden on when asleep, it strikes like lightning, and does its rattling afterward. Unfortunately for us, the poisonous snakes do their sleeping in the day time and hunt at night. They are prone to seek the warmth of bed-clothes, and sometimes will coil up alongside of a sleeping man. Mosquito netting is an effective bar against snakes. Snakes despise musk, tobacco, and turpentine.

A snake is not obliged to coil before striking, but can strike from any position; it will coil first, however, unless attacked very suddenly or taken at a disadvantage. A snake does not intentionally throw its venom; but, if it misses its mark, the act of hissing may throw the poison several feet. The blow is delivered with lightning rapidity, and the fangs are instantly sunk into the victim. No snake can leap entirely from the ground, nor can it strike more than two-thirds its own length, unless it has the advantage of striking downhill or from some purchase on a rock or bush. A snake does not expend all its venom at one blow. It is not rendered permanently harmless by extracting its fangs, for auxiliary ones, in various stages of development, lie in a sac in the roof of the mouth, and the foremost of these soon will emerge and be ready for business.

The venoms of different species of snakes differ in composition and in action. That of the cobra, for example, attacks the nerve centers of the cerebrospinal system, causing paralysis that extends to the lungs and finally to the heart, but the local symptoms are not very severe. In marked contrast are the effects of rattlesnake bite, which spread very rapidly through the system, making the blood thin and destroying its power to clot. The wound is

speedily discolored and swollen. Within about fifteen minutes, if no cautery or ligature or serum injection has been applied, the victim becomes dull and languid, breathing with difficulty. The venom first enfeebles the heart, then the lungs. Great swelling and discoloration extend up the limbs and trunk. The temperature rises, the victim staggers, becomes prostrated, is attacked with cold sweats and vomiting, may swoon repeatedly, and death may ensue within ten or twelve hours. If an important blood vessel has been pierced by a fang and considerable venom injected, the victim may die within twenty minutes.

Rattlesnake poison has a tendency to rot the blood-vessels, and may cause a general seepage of blood throughout the system. In some cases a whole limb is soaked to the bone with decomposed blood. Frequently there is suppuration, and gangrene may set in, from which a patient who had recovered from the constitutional symptoms may die a week or more after the injury was received.

Much depends upon the part struck, and the quantity of venom injected. Often it happens that only one fang penetrates, or only the surface of the skin may be scratched. Bites on the bare skin are more dangerous than those received through the clothing. In a large majority of cases the wound does not touch a blood-vessel directly, and the patient will recover with no other treatment than a ligature promptly applied, and a free cutting and kneading of the wound to expel as much as possible of the poison before it has had time to enter the circulation. Such measures, however, must be taken *at once,* as absorption works quickly.

REMEDIES.—The only positive antidote for snake poison, after it has entered the circulation, is anti-venom serum. This is prepared by injecting into a horse or mule a fractional dose of the venom of a snake, or a mixture of those of different species.

When the animal recovers from the effects of this preliminary dose, a slightly larger one is injected, and so on, every two or three weeks, for a year or two. Finally the serum of the animal's blood has developed an anti-toxin that makes him immune to snake venom. Some of his blood is then withdrawn, and the serum is separated, sterilized, and put up either in liquid or dried form in sealed tubes. These must be kept in a cool, dark place, to preserve the serum from deteriorating. A large hypodermic syringe is used to inject the serum into a patient. This treatment will cure the gravest cases of snake bite, if employed before the victim has collapsed. As it is not toxic, it is safe for even inexperienced people to use.

As I have said, there are marked differences in the nature and effects of venoms, according to the species of snake. Cobra venom, from which the Chalmette serum is principally derived, while effective in treating such bites as would be received in India, is not so sure a remedy in our country as an anti-venom developed by using the poison of rattlesnakes or other species of the *Crotalidae*. To cure bites inflicted by the deadly snakes of South Africa, Fitzsimons employs a mixture of venoms from various species in that region with which to immunize horses and develop a remedial serum. In South America, Dr. Vital Brazil, of the Institute of Serum-Therapy of Sao Paulo has made several types of serums that are specific for bites of the rattlesnake, the lance-head snake, the coral snakes, respectively, and one compounded from three venoms, to be used when the identity of the snake is unknown.

The chief disadvantage of anti-venom serum is that its kit is too bulky to be carried habitually on the person. If, however, it is kept in camp, and a first-aid remedy for snake bite is always in one's pocket during the snake season, the adventurer need fear no snakes whatever.

The first-aid for snake bite is very simple and compact. It consists merely of a little permanganate of potash (potassium permanganate) and a lancet or a sharp penknife blade, with belt or other article of clothing that can be used like a tourniquet. The permanganate can be used either in crystals or in tablet form. It must be carried in a waterproof container of glass or rubber. A convenient arrangement is a hard rubber tube resembling a fountain pen, but only 2½ inches long and weighing less than an ounce, which is sold for a dollar by some outfitters. One of the capped ends contains some permanganate, and the other a small spear-shaped lancet (to be honed keen before it is fit to use).

Permanganate of potash merely neutralizes such venom as it comes in direct contact with; it does not follow up the poison and kill at a distance from the wound. Since snake venom diffuses rapidly through the system, it is absolutely necessary to use the permanganate quickly. If more than three minutes have elapsed before application, its value is doubtful; if more than five minutes or six minutes, it will do no good at all.

TREATMENT.—(1). When one has been struck by a venomous snake, he should waste no time chasing the creature to kill it. Within a minute, at most, he should have a ligature bound between the wound and his body to cut off the return flow of blood and lymph to the heart. (It is assumed that he has been struck in a limb, as generally happens.) The ligature may be a neckerchief, handkerchief, or a strip of cloth torn from the shirt, twisted, and tied as tightly as possible around the limb. A belt with tongueless buckle is excellent for the purpose. A stout cord will do. If the bite is anywhere below the knee, apply the ligature just above the knee; if below the elbow, then just above the elbow, because here there is only one bone and compression is more effective. Another may be tied closer to the wound if a foot or hand has been bitten.

Do not twist the ligature up so tightly with a stick as to bruise the flesh. Remember, its object is not to compress an artery, but only the veins, all of which lie near the surface.

(2). Make three parallel cuts, say an inch long and a quarter-inch deep, lengthwise of the limb and through the seat of the wound, then two criss-cross through the fang punctures (unless the bite be on the wrist or top of foot, where you might sever sinews). This is better than a simple X-cut because it makes the wound bleed more freely and opens it more thoroughly to receive the permanganate. Plenteous bleeding carries out a good deal of the poison by itself. Assist it by squeezing or "milking" the wound. The poison of North American snakes (not of the cobra) is harmless to the stomach, and so it may be sucked out, *provided* that the operator has no hollow tooth, nor scratch or abrasion of the mouth, through which it might reach the circulation. It is useless to suck merely the tiny fang punctures—you must first cut them open.

(3). Moisten, with saliva, enough of the permanganate to fill the wound (if it is in tablets, crush two or three of them in the palm of the hand) and rub it thoroughly into the cuts. It is extremely caustic; but the emergency calls for heroic treatment.

(4). If you have a companion, send him at once for the anti-venom kit, or for a doctor. If you are alone, and far from help, stay where you are. Moving about would only force circulation and aggravate the case. The chances are fine for your recovery without any further treatment. If you have strychnine, swallow 1-20 grain to stimulate the heart and nerves, whenever you feel them "going back on you." Or, if you have it, use whiskey or ammonia.

Whiskey is not an antidote; it has no effect at all on the venom; its service is simply as a stimulant for the murderously attacked heart and lungs, and

as a bracer to the victim's nerves, thus helping him over the crisis. For this purpose some pretty stiff drinks may be needed, if strychnine is not to be had; but don't guzzle inordinately; an excess, by its depressive reaction later, may weaken the system alarmingly after the venom itself has been conquered.

(5). In half an hour you should gradually loosen the ligature, permitting some blood to flow back from the injured limb and fresh blood to enter it. Then tighten again. This admits only a little of the poison at a time to the heart. Repeat the alternate tightening and loosening at intervals for a considerable time, until the danger is over. To leave the ligature unloosened for more than an hour, at the farthest, would put you in grave danger of gangrene.

HERBAL REMEDIES.—Many species of wild plants are supposed to have the property of counteracting the effects of the poison of serpents. In any backwoods community you may find some one who claims to know some sovereign herb that will do this. In the seventh edition of my *Book of Camping and Woodcraft* (1915) I named many of these plants and discussed them. This book is out of print, but may be consulted in public libraries by anyone curious in such matters. Scientists of today have no faith whatever in herbal "cures." There are plants that will assist Nature in the way of heart and nerve stimulants, or possibly by inducing copious sweating; but there is none that acts as a real antidote against snake poisoning. As for the backwoodsmen who use herbs as "snake-masters," it will be observed that they have firm faith in the efficacy of "lots o' whiskey" as an adjuvant, if not as a panacea *sine qua non*.

One time I asked an old moonshiner, "Quill" (that was his first name) "if a snake bit you, when you had no whiskey, what would you do?"

"And no liquor to be had?"

"Yes."

"Sir, if a snake tuk sich advantage of me, I'd throw him in the fire!"

Bites of Other Animals.—Ordinarily the bite of a non-venomous animal needs no other attention than cleansing and an antiseptic dressing, unless there is enough laceration to require surgical measures. Still, the bite of any animal, from mouse to man, may be dangerous. Germs from foul teeth may be carried into the wound. Vindictive and long-sustained anger sometimes seems to create a virus in the saliva, so that the bite of a teased and infuriated animal may act almost as a venom. If there be reasonable doubt, cauterize the wound as for snake bite, or with nitrate of silver, or with a nail brought to a *white* heat (not so painful as if only red-hot). This will not, in all likihood, prevent an attack of hydrophobia if the animal was rabid, but it will kill such other poison or germs as may have been introduced.

Rabies.—Hydrophobia (fear or aversion for water) is only a symptom, and is shown only by man, not, as is commonly believed, by dogs. Notwithstanding that there are cranks (even a few of them in the medical profession) who assert that there is no such disease as rabies, it is in fact the most terrible ailment that afflicts mankind. In a great majority of cases, unless the patient is given the Pasteur treatment in due time, he will suffer the most excruciating agony, and death is certain, since no known drug is of any avail. Faith in the curative powers of "the madstone" is nothing but a superstition: the compacted fiber from an animal's stomach, or calculus, or porous stone, which goes by that name merely clings if there happens to be a discharge of blood or pus from the wound, and draws out no virus whatever; for there is none in the circulation—the virus of rabies travels along the nerves.

Epidemics of rabies are by no means confined to domesticated animals. They occur among wolves, foxes. jackals, hyenas, bears, skunks, rats, and even

among birds. It is likely that this disease accounts for the sudden disappearance of certain animals from a given locality, when other explanations fail, as was the case with wolves in the Alleghanies about the beginning of the 19th century.* In Arizona and other parts of the Southwest it is generally believed that the bite of the little spotted or rock skunk is more than likely to transmit rabies; so the animal often is called "hydrophobia skunk." I have already discussed this matter in Vol. I., p. 262.

As regards symptoms, there are two types of rabies:

(1). Furiant or irritable.—First the animal's disposition changes: if formerly playful, it becomes morose; if quiet and dignified, it now grows unusually affectionate, as if seeking sympathy. In the course of a day or two it becomes irritable, and may snap if startled. It begins to wander about, and disappears at intervals, hiding in corners or dark places, from which it resents being removed. Its bark is indiscribably changed. There is no appetite, and the animal has difficulty in swallowing. Saliva may dribble from the mouth, but it does not froth as in a fit. Restlessness and irritability increase until the beast becomes furious, biting at anything thrust toward him, and even at imaginary objects. The creature now begins to take long journeys, and will assault other animals, but never makes any outcry during these attacks. Then signs of paralysis appear. It overcomes first his hind legs, then the lower jaw, and ultimately becomes general. He dies in from five to eight days after the appearance of the symptoms.

(2). Dumb or paralytic.—This type is uncommon. There is no marked irritability. The animal lies stupidly in seclusion. Paralysis comes early and is quickly progressive. Death usually ensues in two or three days.

In man, the period between the bite and the appearance of the symptoms averages forty days. It

*See *Notes on the Settlement and Indian Wars of the Western Parts of Virginia and Pennsylvania, from 1763 to 1783*, by the Rev. Dr. Joseph Doddridge, a contemporary and excellent authority.

may be a year or more; it may be only two weeks, or even less if the bite was a bad, lacerating one affecting important nerves, or in the face. Consequently, when a man is bitten by an animal known to be rabid, or by one that develops rabies within less than forty days after it has inflicted the bite, he should be sent at once to a Pasteur institute. If he goes in time, he has ninety-nine chances in a hundred to recover. Otherwise, unless the wound was so superficial as to have done no injury under the skin, and it was promptly cauterized, his chance is scarce one in a hundred.

INSECT STINGS AND BITES.—These have already been discussed at some length in Vol. I., pp. 241-259. An application of honey, moistened salt, or of ammonia, or a cloth saturated in a solution of baking soda, or even wet earth, will suffice in all ordinary cases. Our most dangerous insect is the common housefly: "it does not wipe its feet."

WOUNDS—There is no room in this chapter to describe and illustrate the structure and mechanics of the body, nor how to apply bandages and splints, nor to give any but general directions for the treatment of wounds, dislocations and fractures. If one is going far from medical help, I cannot too highly recommend that he should take some instruction in such matters, or at least carry with him the very clear and concise *American Red Cross Abridged Text-book on First Aid* (general edition), by Mājor Charles Lynch, of the Medical Corps, U. S. A. This book, as well as a variety of first-aid packets and fitted boxes, is sold by the American Red Cross, Washington, D. C., from whom a catalogue may be procured on application.

Bleeding.—Rather free bleeding is good for a wound, because the blood washes out many, if not all, of the dangerous pus germs that may have entered at the time of the injury. Do not touch the wound with the fingers, nor with anything else than a surgically clean instrument and compress. Observe whether the bleeding is arterial or venous.

If it comes from a *vein,* the blood will be *dark* red or purplish, and will flow in a steady stream. If an *artery* is cut or lacerated, the blood will be *bright* red, and it probably will spurt in jets. Bind the compress on firmly. Generally this will suffice to stop the bleeding.

In case of arterial bleeding, try to locate the artery *above* the wound (between it and the heart) by pressing very hard where you think the artery may pass close to a bone, and watch if this checks the flow. If so, then, if the vessel is only a small one, just continue the pressure: it is likely that a clot will form and the artery close itself. In extremity, the flow from even a large artery can be checked for a while by pressing very firmly with thumb and finger directly into the wound. There is record of an Austrian soldier who stopped bleeding from the great artery of the thigh for four hours by plugging the wound with his thumb; if he had let go for a minute he would have bled to death. But if the injury is so situated that a tourniquet can be applied (anywhere except in the neck, body, or very close to the body) one can readily be extemporized.

Tourniquet.—Tie a strong bandage (handkerchief, belt, suspender, rope, strip of clothing) around the wounded member, and between the wound and the heart. Under it, and directly over the artery, place a smooth pebble, a cartridge, piece of stick, or other hard lump. Then thrust a stout stick under the bandage, and twist until the wound stops bleeding. The lump serves two purposes: it brings the most pressure where it will do the most good, and it allows passage of enough blood on either side to keep the limb from being strangled to death. However, do not apply more pressure than is needed to stop the bleeding—excessive pressure of a hard lump may rupture the blood-vessel.

If the position of the artery above the wound cannot be determined, then, in case of a gaping wound that would be hard to plug, apply the tourni-

quet without any lump, and twist it very tight indeed. This can only be done for a short time, while you are preparing to ligate the artery; if prolonged, it will kill the limb, and gangrene will ensue. In case of a punctured wound, such as a bullet hole, it is better to push a plug of sterilized gauze hard down in the wound itself, leaving the outer end projecting so that a bandage will hold the plug firmly on the artery. This must be done, anyway, wherever a tourniquet cannot be used.

Ligating.—The above expedients are only temporary; for a cut artery, if of any considerable size, must be ligated—that is to say, permanently closed by tying one or both of the severed ends. To do this you must have at least a pair of sharp-pointed forceps or strong tweezers. Get hold of the end of the artery with this, draw it out, and have some one hold it. Then take a piece of strong thread that has been sterilized in boiling salt water (supposing you have no regular antiseptic) make a loop in it as for a reef knot, but pass the right hand end of the thread *twice* around the other, instead of once (Fig. 193—surgeon's knot—it will never slip). Slip this loop down over the forceps and around the end of the artery, and draw tight. If the vessel bleeds from both ends, ligate both. When an artery is merely ruptured, not severed, cut it clean in two before operating; it will close better.

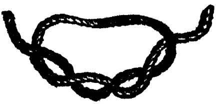


Fig. 193.—Surgeon's knot

Nosebleed.—If the nose does not stop bleeding of itself, hold against the nape of the neck a cloth wrung out in cold water. Put a roll of paper between the upper lip and the gum. Do not blow the nose nor remove the clots. Holding the arms above the head will help. If the bleeding still continues, dissolve a teaspoonful of salt in a cup of water, and snuff some of this brine up the nose.

Should these measures fail, make a plug by rolling up part of a half-inch strip of gauze or soft cloth,

push the plug gently up the nose with a pencil, pack the rest of the strip tightly into the nostril, and let the end protude. If there is leakage backward into the mouth, pack the lower part of plug still more tightly. Leave the plug in place several hours; then loosen with warm water or oil, and remove very gently.

Internal Bleeding.—This may be either from the stomach or from the lungs. In hemorrhage from the *stomach,* the blood is vomited. It is *brown* or "coffee-ground," and may be mixed with food. There is tenderness and pain in the region of the stomach.

Bleeding from the *lungs* is preceded by a saltish taste in the mouth. Blood rushes from the mouth and nose. It is bright *red* and *frothy.*

Although the disease producing one or other of these symptoms may be grave, yet the attack of bleeding itself is not likely to result seriously. In either case the first-aid treatment is absolute rest in bed, and cold cloths over the affected part. If the bleeding is from the stomach, the patient's head should be kept low; if from the lungs, the head and shoulders should be propped up, unless there be a tendency to faintness.

Cleansing Wounds.—All inflammation of wounds, suppuration, abscesses, erysipelas, "blood-poisoning," gangrene, and lockjaw, are due to *living germs* and nothing else. These germs are not born in the wound, but enter from the outside. We may as well say they are present everywhere, except in the air (pus germs do not float in air). To prevent their entrance is much easier than to kill them once they have gained foothold.

The only guarantee of a wound healing nicely is to make and keep it *surgically* clean. Sterilize everything that is to be used about a wound: hands, instruments, and the dressing. Do not trust anything to be germ-free merely because it *looks* clean. The micro-organisms that cause inflammation of a wound, fever, putrefaction, may lurk anywhere,

even in spotless linen fresh from the laundry, unless killed by antiseptics.

Do not swab out a fresh wound, nor even wash it; that would only drive germs deeper in. Simply cover it with a sterilized dressing for the time being, and cleanse it later with an antiseptic wash, if need be. Plain water is likely to contain germs. If it is necessary first to pick out hard foreign matter that has been driven into the wound, do so with an instrument sterilized by heat or by antiseptics, or made from a freshly cut green stick.

Whenever practicable, shave off the hair for some distance around the wound. Hairs, no matter how small, are grease-coated and favor the lodgment and growth of germs. Shaving also scrapes off the surface dirt and dead scales of skin.

Closing Wounds.—Never cover a wound with court plaster. It prevents the free escape of suppuration, inflames the part, and makes the place difficult to cleanse thereafter. Collodion should be used only to cover small, clean abrasions of the skin, protecting the raw surface.

The only legitimate uses for adhesive plaster are to hold a compress in place where bandaging is difficult, and, in case of a cut, to keep the edges closed without sewing the skin. In the latter case, after placing a narrow compress over the cut, the wound may be drawn together by crossing it with narrow but long strips of plaster, leaving spaces between. A better way, by which I have nicely healed some rather bad gashes, is as follows:

Lay a broad strip of adhesive plaster on each side of the cut, half an inch apart, and extending beyond the wound at each end. Stick these strips firmly in place, except about a quarter of an inch of the inner margins, which are left loose for the present. With needle and thread lace the strips (deep stitches, so they'll not pull out) so as to draw the edges of the wound together, and then stick the inner margins down, not covering the wound.

Sewing a wound should be avoided by inexperi-

enced persons, unless it really is necessary, as in the case of a foot partly severed by an axe-cut. If an ordinary needle and thread must be used (by no means an easy job) sterilize them by soaking in a boiling solution of salt and water. (It is here assumed that no better antiseptic agents are available. Sugar and water, or vinegar will do in a pinch.) Do not sew continuously over and over, but make a deep stitch and snip off the thread, leaving enough at each end to tie with by and by. Repeat this at proper intervals, until enough stitches have been taken; then, go back and tie them, one after another, with surgeon's knot (Fig. 193). Such sewing is easy to remove when the proper time comes, say within about six days.

Punctured Wounds.—To remove a splinter: slip the point of a small knife-blade under the protruding end and catch it with the thumb-nail; or, use a needle sterilized in flame, or tweezers. Bits of glass should be cut out, lest they break.

If a fish-hook is embedded in the flesh, never try to pull it out backward. Push it through until the barb appears, clip this off with nippers, and withdraw. If you have no nippers, cut the hook out—in fact this is good treatment, anyhow, for the wound then is open for antiseptic treatment, and will heal without danger of festering.

A puncture from a rusty nail, or the like, should be slit open so that your antiseptic is sure to reach the bottom. This hurts less than cauterizing, and is quite effective. If a small punctured wound is not cut open, soak it in sterilized hot water, and squeeze out as much as possible of the poisonous matter that may have been introduced. Never cover a punctured wound with plaster or collodion.

Gunshot Wounds.—If it is only a flesh wound from a rifle or pistol, simply apply a sterilized compress and bandage it in place, being careful not to touch the bullet hole with your fingers or anything else unclean. When a bone is broken, apply splints. If the bullet has not gone through, but is deeply

embedded, let it alone; the chances are that it will do no serious harm. Never probe a bullet wound. Do not pick out pellets of shot unless they are just underneath the skin.

If bits of clothing have been driven into the wound, and they are not too deep to reach by a little cutting, remove them; the cloth is almost sure to be alive with germs.

When there is extensive laceration, as from an expanding bullet, or from a charge of shot fired at close quarters, check the bleeding, apply an antiseptic dressing, keep the patient still so as not to renew bleeding, and treat for shock. No stimulants, unless absolutely necessary to prevent collapse.

Bruises.—Severe bruises should be treated promptly by applying very cold water to the part, if it can be obtained. A cloth wrung out in very hot water will accomplish the same purpose, which is to limit swelling, prevent discoloration, and reduce pain. "It always seems strange that the two opposites—cold and heat—should have the same effect on the blood-vessels, but this is actually the case. . . . Every one knows how shrunken the hands look after they have been in hot water for some time."

Sprains.—These, too, may be treated with either heat or cold. Perhaps the best way, before swelling has commenced, is to immerse the injured member in very cold running water, or let cold water drain on it from an elevated vessel. The joint itself, should be elevated, too, if possible. Keep this up as long as you can stand it. Then dissolve tablets of lead acetate and opium (directions on bottle) in water, soak a cloth in it, bind round the joint, and keep the cloth wet with the lotion.

If no treatment can be applied until the joint has already become swollen and painful, then immerse it in water as hot as can be borne, and raise the heat gradually thereafter to the limit of endurance (much hotter than you could stand at first). When the pain lulls, change to an application of cloth

wrung out in very cold water, and keep pouring cold water on as this warms up. A little later, strap the joint with adhesive plaster.

According to Gibney, the following treatment for a sprained ankle "involves no loss of time, requires no crutches, and is not attended with any impairment of functions":

> A number of strips of rubber adhesive plaster, about 9 to 12 inches in length and of appropriate width, are prepared. Beginning at the outer border of the foot, near the little toe, the first strip partially encircles the joint, and ends behind the foot. The second strip is begun on the inner side of the foot and is applied on the opposite side, nearly meeting the first strip behind. Other strips are applied in like manner, each one over-lapping the last and crossing its fellow of the opposite side in front, so that the ankle is snugly and smoothly encased, care being taken not to encircle completely the joint with any one strip. After having bound the foot firmly, it is well to add one broad strip, running around the foot from the internal side of the leg down the internal side of the foot, across the sole of the foot, and up the outside of the leg, "as much as possible to take the place of the middle fasciculus of the external lateral ligament, which is so often the one most injured." It is a good plan to place a pad of absorbent cotton over the external malleolus [outer knob of ankle] and in the depression below, to prevent undue pressure and chafing. Any one of the injured ligaments may receive a similar reinforcement from an extra strip. Then apply a roller bandage smoothly over the entire surface, allowing it to remain until the plaster takes firm hold.

The pain of a sprained joint may be alleviated by gently rubbing in a mixture of equal parts of alcohol and water, or arnica, or witch hazel. Rubbing should always be toward the body.

HERNIA (Rupture).—This may result from violent exertion, over-lifting, or other cause. Have the patient lie on his back, with a pillow or pad under his hips, and thigh drawn toward the body. Tell him to breathe evenly and naturally. Gently

press the neck of the hernia back in line with the middle of the canal through which it has descended. If it does not return after a little manipulation, apply cold cloths for an hour, then try again. Do not persevere long enough to set up inflammation. If successful, cover with a pad tightly bandaged over the groin. If not, keep the patient on his back until medical help arrives.

DISLOCATIONS.—If a joint is dislocated, or a bone broken, don't grasp the limb at once and pull; but first consider the anatomy of the injured part. Rough and unskilled handling is likely to do more harm than good.

A dislocation means that the head of a bone has slipped out of its socket, probably tearing the ligaments, and has failed to slip back again as in a sprain. Some dislocations, particularly of the wrist or ankle, are hard to distinguish from fractures.

When you must operate on a comrade, go to work at once, before the muscles have become rigid and the joint badly swollen. Should much difficulty be experienced, do not persist in trying to get the joint into place, but surround it with flannel cloths wrung out in hot water, and support with soft pads, until a surgeon can be found.

After a dislocation has been reduced, the joint must be kept rigid with bandages or splints for a considerable time, as the ligaments are weak and a recurrence of the trouble is all too easy.

Three dislocations out of every four are in the shoulder, arm, or hand, and among these, dislocation of the shoulder is most frequent.

Fingers.—Pull straight out away from the hand. Generally the bone will slip into place. Dislocation of the thumb is more likely to be forward than backward. Press the thumb backward and at the same time try to lift the head of the bone into its socket. If you fail, after one or two trials, go for a surgeon.

Wrist.—Fracture is more common than dislocation of the wrist. If in doubt, treat as a fracture.

When there is only a bone out of joint, it may be replaced by pulling strongly upon the hand.

Elbow.—Leave this dislocation for a surgeon, if practicable. Otherwise, have the patient sit on a chair or log, and plant your foot against it. Place your knee against the front of his upper arm just above the bend of the elbow. Then, grasping the bone of the upper arm with your right hand, and the wrist with your left, forcibly bend the forearm, using your knee as a fulcrum. If the dislocation is forward, however, pull upon the forearm while the upper arm is fixed. Your thumb can assist in pressing the head of the bone in the desired direction. Put the arm in a sling (hand higher than elbow) and bandage it in place to prevent movement.

Shoulder.—About one-half of all cases of dislocation are of the shoulder joint. Have the man lie down flat on his back, and seat yourself by his side, facing him. Remove your shoe, put your foot in his arm-pit, grasp the dislocated arm in both hands, push outward and upward with the heel, and at the same time pull the wrist downward and outward, then suddenly bring it against the patient's hip. When a snap is heard or felt, the joint is in place. Bandage the upper arm to the side, with a thick pad under the arm-pit, forearm carried across chest, and hand on opposite shoulder.

Lower Jaw.—This dislocation must be reduced immediately. It looks serious, and alarms the patient, but in reality is very simple to reduce. Wrap both of your thumbs in several thicknesses of cloth, to protect them. Place them upon the patient's lower back teeth, and press forcibly downward and backward, while the fingers force the chin upward. As soon as the jaw starts into place, slip your thumbs off the teeth into the cheeks, to avoid being severely bitten. Put a jaw bandage on the patient.

Hip.—To reduce this dislocation is a job for nobody but a good surgeon.

Knee.—Try a strong, steady pull. If successful apply a splint. There will be a great tendency to inflammation, which is to be combatted with cold applications, or lead and opium lotion.

Ankle.—The patient lies down and bends his leg to a right angle at the knee. Then he, or an assistant, grasps his hands around the thigh and pulls backward, while you pull the foot steadily toward you. When reduced, support the joint with a right-angled splint made by nailing two pieces of board together in that position, one for the foot and the other for the lower leg.

FRACTURES.—If a bone is broken, and a surgeon can be summoned within a couple of days, do not try to reduce the fracture. Place the man in a comfortable position, the injured part resting on a pad, and keep him perfectly quiet. In lifting the limb to slip the pad under, one hand should support the bone on each side of the break. Be very careful that the flesh and skin shall not be cut by the knife-like edges of broken bone, as such after-injury may have serious consequences.

It may be, however, that you must act as surgeon yourself. If the bone is broken in only one place, and it does not protrude, the injury is not serious. Get splints and bandages ready. Rip the clothing up the seam, and steadily pull the broken parts in opposite directions, without the slightest twisting. Begin gently, and gradually increase the strain. It may take a strong pull. When the two pieces are end to end, an assistant must gently work them till they fit. This will be announced by a slight thud. Then apply splints, and bandage them so as to hold the injured member immovable while the fracture heals.

Bark, when it can be peeled, makes the best splints for an arm or leg. Pick out a sapling (chestnut, basswood, elm, cedar, spruce) as near the size of the limb as possible. Remove the bark in two equal pieces by vertical slits. These should

be longer than the bone that is broken, so as to clamp the connecting joints as well. Cover the concave insides with cloth, dry moss, crumpled grass, or other soft padding, to cushion the limb and prevent irritation. The edges of splints should not quite meet around the limb. Then get a long bandage, about two inches wide. Having set the bone, apply the splints on each side, and bandage them firmly enough to hold in place, but by no means so tightly as to impede circulation.

In default of bark, almost anything will do for splints that is stiff enough to hold the parts in place —barrel staves, thin boards, sticks, bundles of rushes, etc. Pad them well.

If a bone is broken in more than one place, or if it protrudes through the skin, and you cannot fetch a surgeon to the patient, then get him out of the woods at all hazards. The utmost pains must be taken in transporting him, lest the sharp edges of the bones saw off an artery or pierce an important organ.

TRANSPORTATION OF WOUNDED.—A two-horse litter is better than a travois; but if the latter must be used, then make one shaft a little shorter than the other, so that, in crossing uneven places, the shock will not all come at one jolt.

"A travois may be improvised by cutting poles about 16 feet long and 2 inches in diameter at the small end. These poles are laid parallel to each other, large ends to the front, and 2½ feet apart; the small ends about 3 feet apart, and one of them projecting about 8 or 10 inches beyond the other. The poles are connected by a crossbar about 6 feet from the front ends and another about 6 feet back of the first, each notched at its ends and securely lashed at the notches to the poles. Between the crosspieces the litter bed, 6 feet long, is filled in with canvas, blanket, etc., securely fastened to the poles and crossbars, or with rope, lariat, rawhide strips, etc., stretching obliquely from pole to pole in many turns, crossing each other to form the basis for a light mattress or an improvised bed; or a litter may be made fast between the poles to answer the same

purpose. The front ends of the poles are then securely fastened to the saddle of the animal. A breast strap and traces should, if possible, be improvised and fitted to the horse. On the march the bearers should be ready to lift the rear end of the travois when passing over obstacles, crossing streams, or going up-hill." (*U. S. A. Hospital Corps.*)

An emergency litter can be made of two coats and two strong poles. Turn the sleeves of the coats inside out. Place the coats on the ground, ends reversed, bottom edges touching each other. Run the poles through the sleeves on each side. Button up the coat, and turn the buttoned side down.

Another way is to spread a blanket on the ground with the two poles at the edges of its long sides. Then roll the edges on the poles till a width of about 20 inches is left between them. Turn stretcher over before using it.

An excellent litter is a big trough of heavy bark, padded or lined with browse, and attached to a frame swung between two poles.

Always test a stretcher before placing a patient upon it. Do not carry it upon the shoulders, except as the rear man does so in going up a steep place. Keep it level. Carry the occupant feet foremost, unless going up-hill. The bearers should walk out of step, to avoid a jolting motion.

Two men can carry one, if he is conscious, very comfortably by forming a "two-handed seat." Number 1 grasps with his right hand the left wrist, and with his left hand the right shoulder, of the other bearer. Number 2 grasps with his left hand the right wrist, and with his right hand the left shoulder, of No. 1. The injured person is seated on his comrades' crossed fore-arms, and throws his own arms over their shoulders.

One man can carry another across his back, even though the stricken one be insensible, and a heavy-weight at that. Turn the patient on his face. If he is conscious, tell him to relax (make himself limp). Step astride his body, facing toward his

head. Lean forward and, with your hands under his arm-pits, lift him to his knees. Then, clasping your hands over his abdomen, lift him to his feet. Immediately grasp his right wrist with your left hand, draw the arm over your head and down upon your left shoulder. Then, shifting yourself in front, stoop and clasp the right thigh with your right arm passed between his legs, your right hand seizing the patient's right wrist. Finally grasp the patient's left hand with your left, steady it against your side, and rise.

Burns and Scalds.—First exclude the air and apply cold. If you are near a running stream of water, plunge the burnt member in it. This is all that is needed in ordinary cases. A good emergency treatment is to make a thick lather of toilet soap, smear it over the burn, and apply a bandage.

A standard remedy is common baking soda (not washing soda*). Dissolve some in as little water as is required to take it up; saturate a cloth with this, and apply, covering the burned area closely, and keep the dressing wet with the solution. Carbolized vaseline, resinol, unguentine, plain vaseline, or almost any clean and unsalted grease or oil, are good applications. Or, make a thin paste of flour and water, smear it on the burned part, and on the cloth used for covering. In lack of anything else, moist clay or earth will do if the skin is unbroken.

If clothing sticks to the burn, do not try to remove it, but cut around and flood with oil or water. Prick blisters on two sides, with a needle sterilized in flame, and remove the water by gentle pressure.

In case of shock, give a stimulant and apply heat to the extremities. When the destroyed flesh of a deep burn softens and begins to slough, hasten its removal by hot applications and cutting the loose ends away with scissors.

*Baking soda is the bicarbonate; washing soda, or plain soda, is the carbonate; do not confuse them.

Rescue from Fire.—Tie a wet handkerchief over your nose and mouth. If unable to breathe when erect, crawl with head as low as possible. If the clothing catches fire, lie down and roll over slowly, beating out the fire with the hands or smothering it with earth. When rescuing another person whose clothing is aflame, throw him down and do the same, or wrap him as tightly as possible in a blanket, coat, or the like, leaving only his head out. Woolens do not burn with a flame like cotton and linen.

FROSTBITE, FREEZING.—In extreme cold, let each member of a party watch the others for the white spots that denote frostbite. These should be rubbed with a woolen mitten or glove, rather than snow. If the freezing is severe, so that the tissues are stiff, rough rubbing and twisting may break them. The return to warmth must be gradual, as a sudden reaction is dangerous to the vitality of the parts. Keep out in the cold, rub the frozen surface gently with snow, or ice-water, until the natural color of the skin is restored.

To toast frost-bitten fingers or toes before a fire would at least bring chilblains, and thawing out rapidly a badly frozen part would result in gangrene, making amputation necessary. When circulation is restored, rub with kerosene, whiskey, or alcohol and water. This will keep the skin from peeling off. In case the frostbite is old and blackened, or the skin has begun to slough off, treat it just as you would a burn.

When in danger of freezing to death, compel yourself to keep awake and moving. If there are two or more of you, beat each other unmercifully with sticks. To sleep is death. Do not drink liquor: the reaction from it is likely to be fatal.

In rescuing one who is almost insensible from cold, take him into a *cold* room. Rub his limbs toward the body to restore circulation, first with rough cloths wet in cold water, then in warmer and warmer water, finally with alcohol and water.

Heat the room gradually. As soon as he can swallow, give him a stimulant.

If the patient has stopped breathing, use artificial respiration (see DROWNING), for several hours if necessary. While one person is doing this, another must keep up the rubbing and massage. "Instances are on record of recovery after several hours of suspended animation,"

CHILBLAINS.—If unbroken, rub lightly with diluted alcohol, whiskey, or alum water. If broken, apply boric acid or an ointment. The Red Cross treatment is: "Paint every two or three days with tincture of iodine pure or diluted with alcohol. Several coats of collodion at intervals of a few days are also good, as the collodion exerts considerable pressure on the dilated blood-vessels."

CORNS.—"Hard corns should never be cut, but should be rubbed down smooth with sandpaper after washing the skin. They should then be covered with a corn plaster or a piece of adhesive plaster. Cutting a corn, if you get below the hard skin, is likely to prove very dangerous, as it often results in blood-poisoning.

"Soft corns should be treated by careful washing and drying of the foot, especially between the toes, then dusting in a little talcum powder and keeping the toes separated by a small piece of gauze." (*Red Cross.*)

INGROWING TOE-NAIL.—Toe-nails should always be cut straight across; rounding off the corners is one great cause of the complaint. A piece of tinfoil, doubled or trebled, may be inserted between the granulations and the nail and all kept dusted with boric acid.

CHAFING, BLISTERS.—See Page 140.

BOILS.—These come from infection of the hair follicles. Hot antiseptic poultices will help draw the boil to a head. I am aware that the practice of poulticing boils and felons is discredited by many authorities; but this, I think, is chiefly due to the fact that a poultice as commonly made is an ideal

breeding-ground for germs. That can be prevented by the addition of a good non-irritant antiseptic. The advantage of a poultice over a fomentation is that it holds the heat longer, and so does not require constant renewing. Its function is to bring the pus near the surface where it can readily be opened. Deep lancing entails more risk of general infection, besides being dangerous in the neighborhood of large blood-vessels.

As soon as the first evidence of pus appears, open the boil with a thin blade that has been held for a moment in a flame to sterilize it. Cleanse both the cavity and the adjacent skin with a strong antiseptic, and cover with a sterilized dressing, to be renewed frequently. Press out the core as soon as it will come.

If the least trace of pus is allowed to remain on the skin, there is danger that other hair follicles may be infected, from which a crop of boils would result.

ABSCESS, FELON.—Treatment is similar to that of a boil, but, after an abscess has been opened and cleaned, a strip of sterilized gauze should be lightly packed in the opening to afford drainage and keep the wound from closing prematurely. This drain should be renewed twice a day, with thorough antiseptic cleansing all around. The pus is deadly. Be careful that none of it gets on your skin or anything else but the fire where it belongs.

IVY POISONING (Poison Oak, Poison Sumac).—We have three species of plants that secrete an oil which poisons human beings (no other animals) by contact. Most virulent of these is the poison sumac or "poison elder" (*Rhus vernix*), which is distinguished from other sumacs by bearing a *white* fruit like thin clusters of very small grapes, and by its leaf, the edge of which is smooth instead of notched.

The so-called poison ivy (*Rhus toxicodendron*) is readily told from the harmless Virginia creeper by having *three* leaves, instead of five, and from the wild bean vine by its lack of conspicuous flowers

and pods. There are two varieties: one with a smooth-edged leaf, and the other (rarer) with toothed edges. By some it is called poison vine; by others, poison oak. The latter name should be reserved for *Rhus diversiloba,* which does not grow east of the Rocky Mountains. All three of these plants are really sumacs, notwithstanding that the "ivy" creeps on the ground, or climbs trees, walls, or fences, like a true vine.

When poison ivy is in bloom, the spores of its pollen are blown hither and yon by every breeze, and those minute spores bear some of the poisonous oil that makes the plant an enemy of the human race. That is why people who are particularly susceptible may be poisoned if they go within ten feet of the plant.

The poison is of an acid nature; consequently if one rubs his skin with an alkali (such as baking soda, weak ammonia, soap, or wood ashes) before handling the plant, or immediately after doing so, he will be uninjured. Usually one is not aware that he has come in contact with such a plant until the symptoms of poisoning appear. As soon as his skin reddens and begins to itch he should wash in strong soapsuds, and then with alcohol. Generally this will suffice. It he lets the case go until little watery blisters appear between the fingers and inflammation sets in, he must use stronger measures.

The druggist's prescription is: Add powdered sugar of lead (lead acetate) to weak alcohol (50% to 75%) until no more will dissolve; strain, and wash the affected parts with it several times a day. A camper is not likely to have this remedy at hand. It is a dangerous poison if swallowed.

Common baking soda, so often mentioned in this book, is more likely to be available. Dissolve as much of it in warm water as the water will take up, and apply. A similar solution of boric acid is even better. Afterward rub some resinol or other good ointment over the affected parts.

I have cured cases of ivy poisoning that were

two or three days old, where both eyes were swelled shut and other parts correspondingly affected, with applications of the tincture of grindelia. But what acts as a specific in many instances may do little good in another. Edward Cave recommends "boiling a dime's worth of cardamon seeds (capsules with seeds in them) in a pint of water, for a bad case, and applying the 'tea' thus made as a lotion when cold. The more frequent the application the quicker the remedy." Another cure, that is highly praised by J. S. McGehee, is three parts olive oil and one part carbolic acid. If this does not redden the skin a little, he adds more of the acid, very gradually, testing until it "nips." Two applications, eight or ten hours apart, generally cure. This, of course, would not be safe to use over a large surface.

Foreign Body in the Eye.—As I do most of my roaming alone, I usually have in my pocket a tiny mirror with which to help myself if a "red pepper" gnat flies into my eye, or something else of the sort happens, when I am miles from help.

If a foreign body lodges beneath the lower eyelid, there is little or no pain; but if beneath the upper lid, or if embedded in the eyeball, a man is quite out of action until the thing is removed. If the offender cannot be seen, it is probably under the upper lid. When a man is alone, the best he can do in such a case is to pull the upper lid over the lower and hold it so until the tears have a chance to wash the irritating particle away. Close the nostril on the other side, and blow your nose hard. Do not rub the eye, for that might embed the thing.

In examining another person's eye, first have him look up while you press the lower lid down. If the particle is under the upper lid, have him sit down with head bent backward. Stand behind him, place a match across the upper lid half an inch from its edge, and turn the lid up and back over the match.

After a foreign substance has been removed, a few drops of olive oil or castor oil will soothe the eye. This is the best treatment, too, if there is a splinter that you are unable to remove by careful picking.

The best wash for inflamed eyes is boric acid in as little water as is required to dissolve it.

Snow Blindness.—This "is an inflammation of the eye due to the reflection of intense light from the snow. There is blindness, flowing of tears, the whites of the eyes are bloodshot, the lids swollen, Often a pus discharges from the eyes, which is highly contagious and when brought into contact with healthy eyes is liable to transmit the disease.

Treatment of snow blindness:

1. Apply cold cloths which have been on ice or wetted in cold water. Do this for half an hour three times a day, changing the cloths as they become warm.

2. Several times a day hold the eyelids open when lying down and pour into them a stream of cooled water which has first been boiled.

3. At night smear the lids and eyelashes with some pure salve to prevent them gluing together while asleep.

Prevention of snow blindness:

The natives of the far North use eye-coverings which entirely shut out the light except a narrow slit through which they see. Some use smoked glass goggles while still others smear their faces with grease and lampblack to break the glare. It is common among mountain climbers to use actors' grease paint for this purpose. In the Winnipeg region of Canada there are used "horse hair" goggles which are superior to any other protection to the eyes in snow work. They are made entirely of hair woven in a loose mesh, convex over the eyes. I would advise anyone traveling in the North to provide himself with them in preference to glass, which is coated with frost at every change of tem-

perature, is always cold to the face, and is liable to be broken." (*Outing.*)

INSECT IN THE EAR.—"Hold a bright light to the ear. The fascination which a bright light has for insects will often cause them to leave the ear and go to the light. If this fails, pour in warm oil from a teaspoon, and generally the intruder will be driven out." (*Pilcher.*)

EARACHE.—Let the patient hold his head to one side at a right angle. Heat a spoon, pour alcohol into it, and hold close under the head so that the fumes will enter the ear. Or, heat olive oil just hot enough not to burn, put a few drops in the ear, and follow with a small plug of cotton. Earache often is relieved by a bag of hot salt, or the like, as described below for toothache.

The following is recommended by H. W. Gibson: "Take the heart of an onion, heat it in an oven, and put it in the ear, but not so hot as to burn. This not only relieves the earache, but helps to send the sufferer to sleep."

TOOTHACHE.—If there is a cavity, clean it out with cotton on the end of a toothpick; then fill it with another small bit of cotton dipped in iodine, oil of cloves, or ammonia, or dusted with baking soda.

"Toothache, scourge of the wilderness, he cured in a novel way. With a thread and a sheet of writing paper he made a cornucopia, the open end of which he placed flat upon a dish; he then set fire to the upper end of the cornucopia, whereupon the burning paper generated a drop of yellow liquid. This liquid—it is extremely bitter—he applied, with a toothpick and cotton, to the cavity, and the toothache perished amid the howls of the possessor of the tooth." (*A. W. North.*)

Probably the yellow liquid is largely creosote. I have seen my partner treat his own tooth this way.

If there is no cavity, but an abscess, it may sometimes be checked by applying to the gum a counter-

irritant, such as spirits of camphor on a pledget of cotton, or a bit of dough in which red pepper has been mixed, or by painting it with tincture of iodine. A small cloth sack partly filled with hot salt, rice, or sand, and placed under the patient's face as he lies in bed is effective in many cases.

THE END.

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